THE Chemical Age

VOL. LXX 6 MARCH 1954 No. 1808

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Challenge to Common Sense

THERE are certain fields of production or service organisation in which a case for nationalisation can be temperately argued. The Post Office is a commonly ignored example. In theory there is a great deal to be said for making it a State business to run nation-wide postal services; in practice, the State developed such services, converting formerly regional operations of private enterprise into an eventually comprehensive service.

But if the Post Office typifies nationalisation theory, it also provides examples of the dangers of nationalisation in practice. Should the Post Office ever be used as an instrument of Government fiscal policy? It has been much used as such and in comparatively recent times. Huge surpluses have been made on some of the Government's postal services and Chancellors of the Exchequer have been grateful recipients of these calculated windfalls for the State's budgets. Some of the postal services (e.g., telegrams) are run at a loss, and profits from other services are used in balance. Large private companies occasionally have to endure these economic discrepancies between different branches of activity, but they rarely permit such tokens of accurate costing or pricing to last for long.

The Labour Party's most recent policy statement, 'Challenge to Britain,' revealed no reduction of interest in nationalisation; on the contrary there was intensified interest with specific yearnings towards major sections of the chemical industry. Many of us may well suspect that the left wing of that party is allowed extra licence when broadsheets are being composed, but the possibility that with politicians as well as with molecules the dextro- and lævo-forms are only mirror-images must always be borne in mind. Imperial Chemical Industries Ltd., a principal target of these Labour Party aims, has seen fit to reply to those passages in 'Challenge to Britain' which discuss the industry. It is a sound answer and it is timely. In any community whose affairs are determined by common sense and logic it would be a crushingly final answer; but we are not yet living in an age when the actions of politicians or the contents of ballot-boxes are decided by these qualities. In some future general election the primary issue could well be foreign policy or the precarious economics of the social insurance scheme, and not one voter out of every thousand would give a moment's thought to the subject of private or public ownership for the chemical industry; but if the Labour Party obtained a majority, they would argue that they possessed a mandate for all or any of the measures set out in such documents as 'Challenge to Britain.' Those whose views are not strongly tied to any particular party line have long observed that with politcians the old saying, 'Love me, love my dog,' is disastrously applicable.

The number of industries that are theoretically suited for nationalisation is small. There is a logical case for nation-wide uniformity of policy in such matters as the supply of basic commodities like coal, water, gas, electricity, railway services, and postal communication services. Uniformity of policy can be secured under private ownership only by creating conditions of monopoly, and most fair-minded people would agree that the dangers of private monopoly must be met with some measure of state control. Whether that measure of control should be total or partial, direct or

indirect, can be debated *ad infinitum*. It is perhaps at this point that nationalisation begins to be judged not as a theoretical idea but as a practical operation. There is also a strong case for nationalising an industry that is vital but uneconomic within the ordinary range of private enterprise and return on investment; if the State has had heavily to subsidise an industry to ensure its continued operation, the argument that the State should ultimately take over control is at least presentable. Similarly industries that private enterprise cannot initiate — e.g., atomic energy — must be State sponsored. It is impossible to show that Britain's complex and expansive chemical industry falls into any of these theoretical classes of industries. Anyone advocating nationalisation for the chemical industry is motivated by the sheer thirst of confiscation. With no evidence for theoretical justification, and an undeniable amount of evidence that nationalisation is not always effective in practice, this particular challenge to Britain is preposterous even in the strange world of party politics. The moderate terms in which the new I.C.I. publication answers the detailed argument must be commended for their restraint. By contrast the hasty ignorance of the Labour's Party's conception is exposed.

It is said that the chemical industry must expand to keep pace with the requirements of other basic industries. The expansion that I.C.I. alone has made since the end of the war, involving an expenditure of £146,500,000 on new construction, is sufficient answer to any suggestion that freedom from nationalisation has retarded progress. The need for greatly expanded fertiliser production is stressed, an implication that production has been restricted; I.C.I. give the sadly correct answer, that the tonnage of fertilisers farmers are at present willing to use is below rather than above existing productive capacity (see THE CHEMICAL AGE, 1954, **70**, 409). Home chemical production must wherever possible replace imported chemicals—the vagueness of this generalisation is aptly queried. Technically possible, or economically possible? The complex problem of imported chemicals is coldly dissected by I.C.I. and it is shown that a country devoid of certain resources must inevitably import some chemicals in order to produce others. Even when the home production of certain intermediates is possible, the manufacture of more important chemicals may be delayed and restricted if sizeable imports are not made. New industries based on synthetic fibres and plastics must be developed— here again vague meaningless generalisation is exposed. Development is taking place in both production and utilisation as rapidly as possible, but the physical and economic limitations of these new materials must be understood. Any reasonably objective reader of both 'Challenge to Britain' and the I.C.I. reply will gather the emphatic impression that the writers of the former know little or nothing about synthetic fibre and plastics potentialities and that the writers of the latter are accurately informed.

The charge that the present chemical industry 'is under tight monopoly control' is firmly answered. For certain chemicals there are admittedly production monopolies and near-monopolies because their economic manufacture can only be based upon large-scale plant operation. Nevertheless, such chemicals rarely enjoy market monopoly for quite different chemicals can be used as alternatives; this is particularly true of patented chemical products, e.g., I.C.I.'s 'Nitro-Chalk,' nylon and 'Perspex.' In any case, the protection given by patent law creates production monopoly for limited periods of time only. The monopoly of a nationalised industry is absolute: but that of private enterprise is limited.

However, Britain is 'challenged,' as if it were some bold adventure, to embark upon an unspecified programme of partial public ownership with the boundaries of State and private responsibility determined by 'technical and administrative considerations.' In considering four variations of boundary plotting, I.C.I. forcibly demonstrated the chaotic nightmare that would inevitably follow. Even were there theoretical justification for public ownership, it is made clear that partial nationalisation of the chemical industry is both impracticable and improvident.

Notes & Comments

Domestic De-Odorisers

A CASE of accidental gas-poisoning reported last week (see THE CHEMICAL AGE, 1954, **70**, 523) inevitably raises queries about the use of modern household de-ordorisers. Unpleasant 'smells' are not always unwanted. There are also times when they serve as danger-signals. De-odorising equipment cannot be regarded as wholly selective, dismissing those smells that are merely objectionable while having no effect upon those that can warn the housewife of potential disaster. The *modus operandi* of some de-odorisers is not primarily absorptive. One constituent sometimes used is a volatile substance that acts upon the nerves controlling the physical act of smell perception, i.e. the individual's capacity to smell is reduced or retarded. The capacity to smell varies very widely among individuals, a fact long recognised by those who have developed tasting and odour-assessing panels. It is therefore probable that any chemical substance which can act upon the olfactory nerves will have widely differing effects upon different persons. Individual reaction may be a much more variable factor than dosage; for a like dosage, the duration or intensity of the effect may be much greater for one person than another. It is certainly relevant that in the case of gas-poisoning referred to, South Eastern Gas Board experiments were reported to show that some people were unable to detect an appreciable concentration of coal gas when the de-odoriser concerned was present.

Hidden Hazards

AN inability to detect a leak of gas in the kitchen may lead to explosion or fire. A smell of scorching may be masked and a minor mishap in the home converted into a much more serious destruction of goods or property. Food poisoning may result from the neutralising of a warning 'off' smell. None of these potentialities should be dismissed as trivial for the kitchen is a prolific site of dangerous accidents. For many people the modern de-odoriser may be safe and useful; employed only when needed and placed close to the source of a known and objectionable smell, it may exert a mainly selective effect. But can this also be said if the user is a person with high sensitivity to the ingredient or ingredients that react upon olfactory nerves? There lies the danger, and it might well be examined by the Chemical Research Laboratory or by one of the research units of the Medical Research Council. The steadily expanding use of chemicals in modern domestic life is a development with many vociferous critics, most of them under-informed or sheerly ignorant. It is all the more important that any new chemical use that brings some hidden hazard with its more obvious benefit should be most carefully investigated. A single inquest discounts a plentitude of convenience.

Weedkillers Mark Time?

ACCORDING to a market report from the United States (*Chemical Week*, 1954, **74**, (4), 70-72), 1953 brought a sudden halt to the sales expansion of selective weedkillers like 2,4-D and 2,4,5-T. For the first time a year's business did not set up new records. A good deal of the cause is said to be the fall in farming incomes, but nevertheless 1953 still brought increased sales of fertilisers. Over-production and competitive price-cutting seem to have had a harmful rather than beneficial effect. This is no doubt due to the basic fact that trade with farmers is overwhelmingly handled through local merchants or dealers, and frequent price changes, at any rate when their trend is downward, involve these businesses in losses on their stocks. Dealers in some areas eventually refused to handle 2,4-D products unless they were sold 'on consignment.' In the United States, of course, any efforts by trade associations to preserve price stability are legally forbidden, but here certainly there appears to be an example where the consequent lack of price stability has damaged the market and

brought no benefit to producer, intermediary or consumer. The estimated volume of 1953 sales is that enough weedkiller was handled to treat about 10 per cent of US cropland. It is certainly difficult to believe that the first check to modern weed control development should come at the 1-acre-out-of-10 level. Perhaps the salient factor is that farmers facing economic problems tend to return to mechanical methods of weed control; if this is so, we may well see similar sales-resistance to the selective weedkillers here.

British Caution

WITH production exceeding farm demand, there was more attention to developing the use of selective weedkillers on parkland and roadside grass. Tests have shown that weed control by mechanical methods costs from $200-$400 per mile every two or three years; spray control costs $75 per mile in an initial three-year period, the cost per year falling as a result of reduced weed incidence. These US figures are not unrelated to a question in the Commons earlier this month, when the Minister of Agriculture was told of discontent among farmers and gardeners at the weed infested state of grass and verges and asked to call a conference of local authorities to discuss modern chemical methods of control. The Minister's reply that the subject needed more investigation and that such a conference would be premature is surely a good example of the British go-slow-or-stop attitude towards applying established knowledge and practice.

Scholarship at Cambridge

Endowed by United Steel Companies Ltd.

THE United Steel Companies Ltd. announce that they have endowed a University entrance Scholarship, tenable at St. John's College, Cambridge, which will be open to candidates who intend to study Physical or Mechanical Sciences at the College.

The scholarship will be offered annually at the open examination for Entrance Scholarships and Exhibitions of St. John's College and the emolument will be £100 a year; but the College will be entitled to augment this to bring it up to a total value of £150. The emoluments will be paid without regard to a scholar's financial circumstances.

The award and administration of the scholarship will be left entirely in the hands of the College with discretion to make modifications to the arrangements in the future in order to preserve the purposes for which the scholarship is founded.

The company hopes that the scholars may frequently have the intention of entering industry and be of a type likely to rise to positions of responsibility therein, and it has been suggested that where the intellectual qualifications of candidates are approximately equal, weight be given to personal qualities and background which may be deemed to fit them to become senior executives in industry.

No stipulation is made as to the future career of the scholars, although the company hopes to make contact with the holders of its scholarship and that for a proportion of them there may emerge a common wish that they should make their careers with the company.

Oil Production Rise

LARGE increases in crude oil production were effected during 1953 in Middle East areas where Anglo-Iranian has interests.

The Iraq Petroleum Company Group (in which Anglo-Iranian is a partner) has announced that its fields in Iraq produced 27,220,199 tons last year compared with 18,060,797 tons in 1952—an increase of more than 9,000,000 tons.

At Qatar, 3,997,926 tons were produced last year by the Qatar Petroleum Company, of the IPC Group. This is an increase of more than 750,000 tons on the 1952 figure.

At Kuwait, where Anglo-Iranian has a 50 per cent interest, production rose in 1953 to 42,603,244 tons, exceeding the 1952 total by more than 5,500,000 tons.

Rigid Polyvinylchloride Pipes & Ducting

*by V. EVANS, M.Sc., F.R.I.C., A.P.I.**

POLYVINYLCHLORIDE is now one of the most familiar members of the thermoplastic group. Nevertheless, it is only in recent years that it has been widely used in this country, particularly in its unplasticised or rigid form. It is this unplasticised form of polyvinychloride which is used for the manufacture of pipes and the fabrication of ducting.

Unplasticised PVC is now produced in this country on a large scale and it is thus readily available in quantity. Although it is essentially a polymer of vinyl chloride small quantities of other substances such as lubricants and stabilisers have to be added to avoid difficulties in the processing of the material. In addition, most suppliers of rigid PVC add pigments, and so the material can be obtained in a variety of colours. Unpigmented, rigid PVC is usually light brown in colour and almost translucent.

Rigid PVC is not an easy material to extrude in conventional extrusion machinery and although difficulties can be reduced by the addition of small quantities of plasticisers these must be eliminated, and lubricants and stabilisers cut to a minimum, if the desirable mechanical and corrosion-resistant properties are to be maintained.

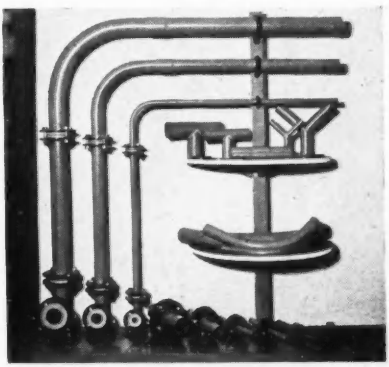
Mechanically, rigid PVC is one of the strongest of the thermoplastics, having a tensile strength of about 8,000 psi., but it must be appreciated that this figure represents a short time loading stress; owing to the creep properties of rigid PVC the continuous loading tensile strength is about 2,700 psi. These figures are for a temperature of 20° and with increasing temperature the tensile strength decreases, so that about 60° is considered the safe upper limit for use. At 80° rigid PVC will no longer support a continuous load.

The chemical resistance is outstanding and rigid PVC is resistant to most acids and alkalis, to oils and to many solvents including such corrosive substances as hydrochloric acid of all strengths, sulphuric acid up to 95 per cent and nitric acid up to about 50 per cent.

Rigid PVC is a comparatively new material of construction in this country and it is very necessary to voice certain warnings. The first concerns its rather low temperature limit of 50° to 60° which must be strictly observed; in certain circumstances this figure can be exceeded slightly but generally speaking it is necessary to keep within this limit. The other main warning concerns the relatively high coefficient of thermal expansion —some seven times that of mild steel— involving adequate care in the provision of expansion bends.

At the present time rigid PVC pipes are available with nominal internal diameters of 1, 1¼, 1½, 2, 2½, 3, 3½, 4 and 6 in. supplied in up to 18-ft. lengths. Two grades are manufactured, one for low pressures and another one with greater wall thickness for medium pressures. The former grade is suitable for continuous working pressures up to 7 psi., and the latter for continuous working pressures up to 45 psi. These pressures are for temperatures up to 20°.

It is necessary to make adequate provision for supporting piping and where it is used at temperatures approaching the safe limit it is simpler to use continuous supports. At normal temperatures supports should be used at 6-ft. intervals for 1 in. diameter pipes and at 3-ft. intervals for 6 in. diameter with corresponding intermediate intervals for the other sizes.



Piping, bends and junction pieces in rigid PVC

* *Special director and chief chemist, Prodorite Ltd.*

Special techniques have to be used for joining pipes and, in contrast to metals, screwed joints are not possible as rigid PVC is very notch sensitive. For permanent joints a very simple procedure is available; a few inches of one pipe end is heated so that the material is slightly softened and while in this state a piece of pipe of the same external diameter is pushed into the pipe. This enlarges the softened pipe, thus forming a socket into which another section of pipe of the same diameter can fit very closely.

The two ends are separated and after cooling to room temperature the two pipe ends are treated with a PVC cement or adhesive and then pushed firmly home. When the cement has hardened a tight, effective joint has been achieved, but as an extra precaution the end of the socket is welded to the other pipe using the now well known hot gas welding process. The joint should be arranged so that the liquid flow is in the direction of the socket.

In the case of joints which may have to be broken and remade, coupling of pipes is usually carried out by means of flanged joints using a backing ring and a flexible washer. Fanges of rigid PVC are carefully welded to the pipe ends but the diameters of the flanges are arranged to be only twice that of the pipes to be joined. Backing rings are used with indiarubber washers inserted between flange and backing ring to avoid undue localised stress on the flange. Between the two flanges a washer of plasticised PVC is inserted thus giving a flexible material on which to pull up the joint. If standard metal backing rings are used it is quite an easy matter to join up PVC pipe lines to standard mild steel and other metal pipes.

Tubes, bends and lip-pieces specially fabricated

Moulded Nylon Bolts

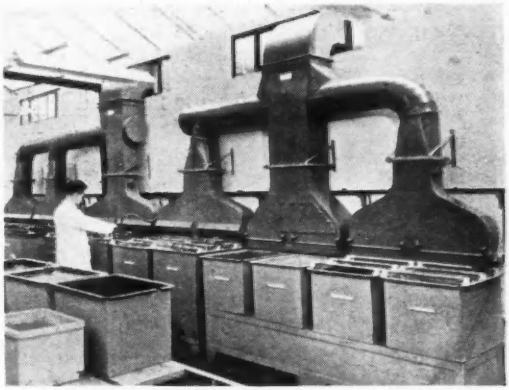
Another development which eliminates entirely all metal parts is the use of ebonite or moulded phenolic resin backing rings in conjunction with moulded Nylon bolts and nuts. In the erection of pipe lines great care must be taken to avoid undue stress when ' pulling up ' flanged joints and some education of fitters accustomed only to steel pipe line erection is very necessary.

Among the many advantages of rigid PVC pipes their extremely low specific gravity of about 1.4 is noteworthy. In practice this means that even allowing for the greater wall thickness of the pipes 5 ft. of 3 in. diameter pipe has approximately the same weight as 1 ft. of 3 in. diameter mild steel pipe for the low pressure range of pipes. This, of course, renders handling a much simpler and safer process.

Other advantages from the safety angle include the reduced weight on walls and other structures on which pipe lines are erected. The very extensive and wide corrosion resistance of PVC will usually take care of any accidental passage of other liquids through the pipe system whereas such a happening with metallic pipes might easily have very serious results. This wide corrosive resistance also takes care of atmospheric corrosion and any corrosive fumes or corrosive liquid drippings which may be present in a chemical works. As previously mentioned, rigid PVC is available in different colours and it is possible to use appropriate colours for different services.

Apart from the chemical industry, rigid PVC pipes will have very extensive application in the food and beverage industries, as recently it has been found possible to use non-toxic stabilisers in the compounding.

Turning to other uses of rigid PVC, principal attention must be given to ducting.



Ducting and fume-hoods of rigid PVC in an experimental plating shop

hoods, tank and vessel linings and similar applications. Rigid, unplasticised PVC is normally available for these purposes in flat sheets of sizes running up to about 6 ft. by 4 ft. and a range of thicknesses from 1/16 in. up to ¼ in. These sheets can be readily machined cold by conventional metal or wood working machinery. In the softened condition pressing, forming, shaping, blowing, deep drawing and welding operations can be carried out.

With the exception of welding, all these operations normally require some form of oven in order to heat the sheet to a uniform, elevated temperature. Normally the material is heated to a temperature of 120° to allow for some fall in temperature in transferring the heated sheet from oven to mould, the optimum temperature for manipulation being about 90°. Oven temperature should not in any case exceed 130° as some decomposition will occur above this temperature.

It is, however, the welding operation which makes PVC such a versatile material of construction. A hot gas torch which provides a stream of air heated to about 280° is directed on the edges to be joined and a welding rod of the same material is also heated so that it fills the space between the softened edges. The process requires some skill but an experienced worker can achieve welds having some 80 to 90 per cent strength of the parent material.

By a combination of these various methods of fabrication it is possible to produce very large and complicated structures entirely in rigid PVC. Consequently all kinds and sizes of ducting, hoods and similar fume extraction equipment can be constructed. Equipment of this type has many advantages over metal structures. The latter require regular coating with suitable corrosion resistant paints to maintain them in good condition and if maintenance is neglected there is always the likelihood of severe corrosion taking place with consequent danger of collapse.

As an example of the size of the equipment which can be carried out in rigid PVC may be mentioned gas washing towers some 22-ft. high by 4½-ft. diameter.

Sometimes square sectioned ducting is preferred bolted together in sections and in these cases use is made of a combination of rigid PVC and steel. The square sections of steel ducts are lined with thin foil about 1 mm. thick which can be firmly adhered to the metal by the use of special adhesives and heat. The sections can be bolted together using chemically resistant, flexible gaskets, such as plasticised PVC, and the external portion, which is normally subjected to less severe corrosive conditions, protected by a good corrosion resistant paint.

Although this article is essentially concerned with pipes, ducting and similar equipment it may not be out of place to mention that tanks and vessels can also be successfully lined with rigid PVC foil by the method mentioned above. An interesting development has been the introduction of the so-called 'combination sheet" in which a thin sheet of unplasticised PVC is pressed on to a thin sheet of plasticised PVC so that a flexible backing material is provided which

will take up stresses and strains due to expansion, etc. This material can be firmly adhered to metal by adhesives and welded in the normal manner.

In conclusion the author wishes to thank the directors of Prodorite Ltd. for their permission to publish this article.

Dutch Nylon for UK

Hercules Powder to Sell 'Akulon'

A RANGE of four grades of 'Akulon,' a new polyamide type of plastic raw material, manufactured by Algemene Kunstzijde Unie NV, Arnhem, Holland, is now being distributed in the United Kingdom by Hercules Powder Co. Ltd. Last week some hundreds of technical executives were the guests of Hercules Powder at a private exhibition held in the Park Suite of the Odeon Theatre, Marble Arch, London. The purpose of this exhibition was to show the interesting properties of 'Akulon' and to show the wide range of industries in which logical applications exist for this nylon material.

'Akulon' is a thermoplastic material which on account of its high softening point can withstand much higher temperatures than the usual thermoplastic materials. Softening points of the various grades run from 200° to 220°. Another special feature of the material is its narrow melting zone; it passes from the solid into a relatively free-running fluid within a range of 10°. It is exceptionally resistant to abrasion, has a low friction resistance, absorbs shocks and greatly reduces noise, is resistant to corrosion, is extremely tough and can be processed and moulded easily.

'Akulon' M2 and K2 are the more rigid forms and 'Akulon' M10 and K10, the more flexible forms of the four grades currently available. The M grades are especially suitable for extrusion and they are tougher and more resistant to wear. For certain purposes grades stabilised against light and oxidation are available. The K grades are particularly suitable for injection moulding and although a shade less tough and hard-wearing than the M grades, they are said to be very good general purpose nylon grades for injection moulding. 'Akulon' K2, as compared with other nylons, is said to mould very easily and to yield uniform products of attractive and brilliant appearance.

The tensile strength of 'Akulon' is 37,000 lb./sq. in. at break and 9,250 lb./sq. in. as limit of elasticity. The elongation is 400 per cent and the impact strength Izod 2-3 ft. lb./sq. in. It is resistant to oils, solvents, alkalis and dilute acids. It dissolves only in phenols and formic acid but will corrode in contact with strong acids.

One of the most important uses for 'Akulon' is in the manufacture of bearings and gears, for it has a long life and needs little or no lubrication. Experience has shown that nylon will outlast metals under many circumstances. It is used in the electrical industry as an extrusion coating for cables and wires, both as primary insulation and a protective sheet.

A wide range of medical, hospital and dental equipment is being made as well as domestic appliances. Hypodermic syringes, trays, basins, and eating utensils can be safely sterilised and 'Akulon' is resistant to alcohols and other solvents and chemicals commonly used in the medical profession. Mugs made from this substance are said to be practically indestructible.

Canadian Cat Cracker

A MAJOR plant expansion programme well under way at the Clarkson (Ontario) refinery of the British American Oil Co., Ltd., includes an 8,000 barrels/day Orthoflow (Model B) catalytic cracking unit, a vapour recovery system, sulphur removal equipment and a catalytic polymerisation plant. Canadian Kellogg Co. Ltd., is in charge of the project.

The Model B Orthoflow—the first in Canada—is one of two versions of Kellogg's exclusive fluid design for catalytic crackers. Both designs involve single vessel construction with straight-line catalyst flow. The principal difference between them is the position of the regenerator which, in Model A is below the reactor and in Model B above it. An advantage obtained with the latter design is reduction in air pressure at which the regenerator operates. Another is a decrease in the size of the reactor and of the fractionator—a result of the higher operating pressure of the reactor.

An Ethoxyline Resin

Some Properties & Uses of Araldite 985B

A NEW class of synthetic resin is providing the answer to many production problems not only in this country but in the US and on the Continent. The limit to its range of uses is by no means in sight but its applications so far have fallen into the following fairly well defined categories:

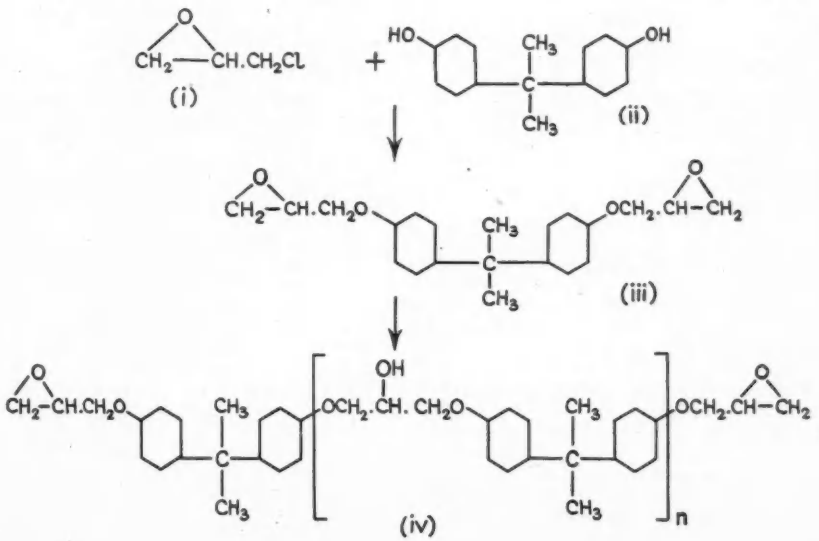
1. Surface coating resins for the protection and sealing of metal surfaces.
2. Adhesives, both hot- and cold-setting. They are said to bond titanium to zirconium, plastics to steel, glass to brass, or rubber to rock, at comfortable temperatures and with the use of little or no pressure.
3. Casting resins, principally used for 'potting' electrical components.
4. Fillers for dents, cracks, etc., in metal panels.
5. Impregnating resins for coils and other electrical equipment.
6. Expanded resins to provide lightweight mechanically suitable materials possessing outstanding electrical properties.

These resins are of interest to the engineering industries, especially where light alloys are concerned, and also to manufacturers of electrical equipment. The surface coatings are also of considerable value to the paint industry and for use by organisations specialising in the protection of metal surfaces. All the above groups are known as ethoxylene or epoxy resins.

Ethoxyline resins may be prepared by the reaction, under alkaline conditions, of epichlorohydrin (i) with a polyhydric phenol, especially the bisphenol, dihydroxydiphenylpropane (ii).

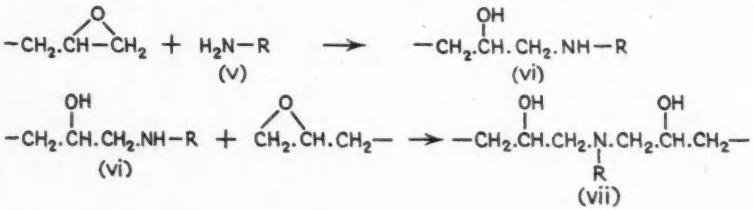
At an intermediate stage in the process both free bisphenol (ii) and epoxy ethers of the type (iii) are present in the reaction mixture. These will co-polymerise under the alkaline conditions to produce the ethoxyline resin, in which the aromatic nuclei are linked together by glyceryl ether systems (iv).

Since both (ii) and (iii) are bifunctional substances the reaction follows the course of a linear polycondensation, similar for example to the formation of a simple polyester from a dibasic acid and a dihydric alcohol, the molecular weight of the final



product being determined by the molecular ratio of the starting materials.

At this stage ethoxyline resins are substances of comparatively low molecular weight, ranging from viscous liquids to fusible brittle solids, and they do not develop their full mechanical strength and chemical resistance until the molecules have been linked together with a suitable hardening agent, preferably with the formation of a tri-dimensional structure. This cross-linking may involve either the hydroxyl groups or the epoxy groups of the molecules or both. The epoxy groups are particularly interesting in that they will react with almost any substance containing a reactive hydrogen atom. For example, with a primary amine (v) a secondary amine (vi) is formed:—



which will in turn react with another epoxy group to form a tertiary amine (vii). By using a polyacidic amine it is clearly possible to obtain a highly cross-linked structure. Other compounds containing active hydrogen atoms react in a similar manner.

An unusual feature of the addition reactions of the epoxide ring is that there is very little change in molecular volume during reaction. This manifests itself in a surprisingly low shrinkage during the curing of ethoxyline resins, which gives them a considerable advantage over other resins, especially in casting and adhesive applications.

The hydroxyl groups of the ethoxyline resin molecule show the properties to be expected from secondary alcohols and can be esterified with organic acids or condensed with the methylol groups of aldehyde resins.

This article gives an account of the properties, chemistry, method of use and industrial applications of one of the coating resins: Araldite 985 E, manufactured by Aero Research Ltd. Briefly, it is a thermo-setting oil-free ethoxyline resin in the form of a solution for use with a mixture of solvents. It consists of two components, known as C1 and C3 which are mixed together in the proportion of one part to three parts by weight respectively and then diluted in mixtures of solvents formulated according to the purpose for which the resin is required. Application of the solution to the surfaces to be treated is by dipping, spraying or roller-coating. The resin is compatible with most pigments or may be dyed to give transparent coloured coatings.

First among the advantages of this Araldite resin is its very good adhesion to metal, as it was originally developed as an adhesive for light alloys. The coatings are a modified form of the same resin and thus give unequalled adhesion to metal surfaces. Secondly, the coatings are smooth, hard, resistant to abrasion and unusually flexible. Thirdly Araldite is resistant to chemicals, foodstuffs and most common solvents as well as to conditions of exposure in which heat and humidity may be encountered.

The two components C1 and C3 (which at temperatures not exceeding 40° have a shelf life of at least a year) are first mixed in the proportions of one part to three parts by weight respectively; the mixture provides a neutral resin of about 50 per cent solids content. Before use it should be allowed to stand for at least 24 hours. At normal room temperatures it has a shelf life of about 3-4 months while dilution with mixtures of solvents in accordance with the suggestions given below increase the period during which it remains usable. The properties of the two components C1 and C3 and of the mixture before dilution are as follows:—

	985 C1	985 C3	985 E
Specific gravity at 21°	0.95–0.98	1.07–1.08	1.04–1.05
Viscosity at 21°	10–15 centipoises	23–35 poises	5–8 poises
Solids content	20 per cent	60 per cent	50 per cent
Minimum shelf life under normal conditions	1 year	1 year	3 months (6 m'ths. when diluted)

Before use, Araldite 985E must be

diluted. Mixtures of solvents such as acetates, ketones, glycol ethers, alcohols and aromatic hydrocarbons are suitable. Aliphatic hydrocarbons should be avoided.

The formulation of solvent mixtures depends upon the method by which the coating is to be applied, by dipping (which is generally the most satisfactory technique) by rollers, or by spraying. The number of approved formulations can be reckoned in hundreds and the following three examples are given only as general indications.

1. *For application by dipping*

500	parts by weight of	Araldite 985 E.
150	,, ,, ,,	Ethyl acetate.
180	,, ,, ,,	Diacetone alcohol or ethyl glycol.
170	,, ,, ,,	Toluene.
1,000		

2. *For application by roller*

(*a*) Rubber roller

555	parts by weight of	Araldite 985 E.
385	,, ,, ,,	Diacetone alcohol.
60	,, ,, ,,	Methyl ethyl ketone.
1,000		

(*b*) Steel roller

523	parts by weight of	Araldite 985 E.
82	,, ,, ,,	Diacetone alcohol.
360	,, ,, ,,	Methyl or ethyl acetate.
35	,, ,, ,,	Toluene.
1,000		

(*c*) Gelatine roller

700	parts by weight of	Araldite 985 E.
70	,, ,, ,,	Diacetone alcohol.
115	,, ,, ,,	Tetralin.
115	,, ,, ,,	Xylene.
1,000		

3. *For application by spraying*

400	parts by weight of	Araldite 985 E.
300	,, ,, ,,	Diacetone alcohol.
150	,, ,, ,,	Toluene or Xylene.
150	,, ,, ,,	Ethyl acetate or butyl acetate.

After the mixing it is advisable to filter or centrifuge the solution. Metal surfaces to be coated should be first degreased and particular care is needed to avoid leaving finger marks. A coating 0.0006 in. thick can be cured within 20 min. at 160° to produce a colourless film while curing at 220° for 160 min. provides a brownish yellow coating. Any selection between these two ranges can be obtained. The highest degree of chemical resistance is provided by coatings that are cured to a light yellow or gold colour.

The adhesion of the coating was demonstrated by coating two aluminium alloy strips and bonding them together to form a ½-in. lap joint. The loading required to separate the two strips was measured in shear in a tensile testing machine. An average load of 3,200 psi. was needed to separate the bonded surfaces, at which figure the surface coating generally parted from the metal.

Tests carried out on the hardness of the coating resulted in figures varying from 77 to 88 (according to stoving conditions) when plate glass was taken as having a hardness number of 100.

Araldite has very good resistance to chemicals. No effect was observed on a single coating after 30 days upon metal panels (stoved at 180° for one hour) from any of the following:—Conc. hydrochloric acid, 10 per cent acetic acid, 40 per cent sulphuric acid, 10 per cent phosphoric acid, 5 per cent formic acid, conc. caustic soda, conc. ammonium hydroxide solution, 10 per cent sodium hypochlorite solution, conc. potassium hydroxide solution.

It has also been demonstrated that coated panels are resistant to 60 per cent potassium hydroxide and to 60 per cent sulphuric acid for at least 5 hours at 80°. Coated aluminium rods have been immersed in 20 per cent hydrochloric acid, 50 per cent lactic acid, 30 per cent caustic soda solution and 0.880 ammonia for more than a year without sign of deterioration. The same coating exhibited excellent resistance to benzene, toluene, xylene, butanol, IMS, methanol, ethyl acetate, ethylene dichloride, petroleum, naphtha, tetralin, turpentine and white spirit. Good resistance is offered to beer, wines, spirits, mustard, tomato purée, and certain fruit juices (though not pineapple juice). Araldite has also been successfully applied to steel, bronze and other metal by the same production techniques.

Coal & Coke Analysis

At the next meeting of the Midlands Society for Analytical Chemistry, to be held in Mason Theatre, The University, Edmund Street, Birmingham, on 9 March, at 7 p.m., Dr. R. A. Mott, superintendent of the Midland Coke Research Station, will speak on 'Recent Developments in the Analysis of Coal & Coke.' He has intimated that he will deal with size reduction and sample division of gross samples; ultimate analysis (C,H,N,S); and the determination of calorific value In these days of high fuel costs and talk of wastages, it is thought that Dr. Mott's talk will be one of particular interest.

Vitamins in Margarine

Food Standards Committee Recommendation

THE Minister of Food, Major the Rt. Hon. Gwilym Lloyd-George, M.P., has approved for publication a Report presented by the Food Standards Committee which recommends that vitamins A and D should continue to be added to all domestic margarine after margarine is decontrolled on 8 May.

The Committee considers that the level of vitamin A in margarine should be equivalent to that of average butter as offered for retail sale, and that the present level of fortification with vitamin D should be maintained.

Tolerance Allowed

A tolerance of ± 10 per cent should be allowed for both vitamins to cover any unevenness in the mixing and any possible loss in manufacture or storage; and further, that the contribution of provitamin A should be taken into account in assessing the total vitamin A content. The Committee does not feel that it is necessary to stipulate the source of vitamins A and D to be used in the fortification of margarine.

A statutory standard for vitamin A content can be enforced provided that an approved method of analysis is prescribed. A suitable method is in fact available.

As regards vitamin D, the only method so far available is that of biological assay. This is time-consuming and expensive, and few Food and Drugs Authorities could be expected to carry it out at the present time. The Committee has therefore examined the possibilities of the use of an approved master-mix, containing the two vitamins in the proper proportions. If such a master-mix were added to margarine, the vitamin D content could be deduced from estimations of the vitamin A content of the margarine.

The Committee consequently considers that the use of a master-mix should be made obligatory and that the formula should be subject to the approval of the Minister.

The Committee recommends:—(i) that statutory standards for the vitamin A and D contents of home-produced and imported domestic margarine should be prescribed; (ii) (a) that the vitamin A content should be between 27 and 33 IU per gm. (760-940 IU per oz.) and the vitamin D content between 2.9 and 3.5 IU per gm. (80-100 IU per oz.); (b) that for the purposes of this standard the vitamin A content should be calculated as the sum of the vitamin A present as such or as its esters plus 0.8 times the β-carotene equivalent of any carotenes present, α-carotene being considered as equivalent to half its weight of β-carotene; (c) that when red palm oil is used as a source of carotenes, the β-carotene equivalent should be taken as 53.5 per cent of the total carotenes;

(iii) that the vitamins should be required to be added in the form of a master-mix containing vitamins A and D in known proportions, the composition of each master-mix to be subject to the approval of the Minister;

(iv) that the method of analysis for vitamin A should be prescribed by the Minister;

(v) that a statement of the vitamin content in IU per oz. should appear on the wrappers of all domestic margarine packed for retail sale.

Italy's Chemical Progress

CONSIDERABLE progress has been achieved in Italy's chemical industry, which is now dependent only to a small extent on imported materials. The production of fertilisers, dye extracts, caustic soda and sulphate of copper has been particularly noteworthy.

While Italy is almost wholly dependent on foreign imports of crude oil, enough distilleries and refineries have been built to change the country from a wholly importing nation in the matter of finished products into an exporting one.

The production of cellulose for the paper industry has registered considerable improvement.

Among metals, the biggest increase was in the production of bauxite, which in 1938 (Venezia Giulia excluded), was barely 9,480 tons, and rose to 281,458 tons in 1952. Output of iron rose from 130,911 tons in 1946 to 720,237 tons in the first seven months of 1952. Lead production also showed a big increase.

The Nitroneal Generator

New Apparatus for Producing Protective Atmospheres

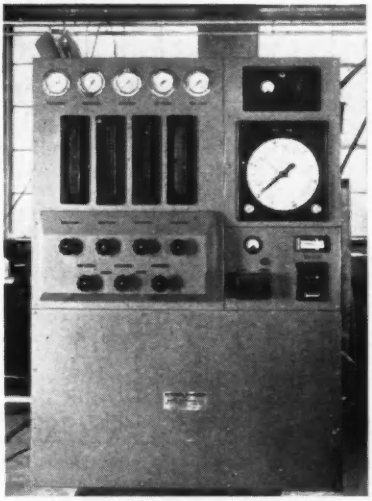
THE vast literature on controlled atmospheres for annealing metals testifies to the great industrial importance of the subject. In general the ideal atmosphere is one which does not react in any way with the metal and, in the case of certain rarer metals which are now becoming of importance, only the truly inert gases, helium, argon, etc., can be used. For the majority of the common metallic materials used in engineering, however, nitrogen also is inert, and this gas is used on a small scale for heat-treatment.

The production of oxygen-free nitrogen requires large and expensive plant, and with a few exceptions, the cost of this gas is prohibitive. In any case, an inert atmosphere only affords complete protection where there is no possibility of the atmosphere being contaminated either by leakage of air or by evolution of oxygen from refractories or other parts of the vessel in which the heat-treatment is being carried out. For this reason it is desirable to provide in the nitrogen a small percentage of a reducing gas such as hydrogen, to take care of any adventitious contamination, and such mixtures are ideal atmospheres for many metallurgical heat-treatment operations.

Cracked Ammonia Widely Used

Mixtures of hydrogen and nitrogen are used fairly extensively; and a very convenient method of producing such mixtures is by the dissociation of anhydrous ammonia. Ammonia is readily available in a high state of purity, and with exceptionally low water content. It liquefies readily on compression and, therefore, a large quantity can be packed and transported in a steel cylinder. Cracked ammonia is widely used in the metallurgical industry, especially where very high purity justifies the expense. The high proportion of hydrogen (75 per cent) puts it in the same category as hydrogen itself, as regards inflammability and reactivity, and its use is, therefore, limited both as regards scale of operation and nature of the work being done.

To overcome these drawbacks, and also to reduce the cost, apparatus has been developed and fairly widely used in which the cracked ammonia is burnt with a slight deficiency of air to give nitrogen containing a small percentage of residual hydrogen. Provided precautions are taken to ensure cleanliness of the air, i.e. freedom from obnoxious impurities such as sulphur compounds, etc., and the burnt gas is thoroughly dried, the resulting hydrogen-bearing nitrogen retains substantially the advantages of the original cracked ammonia without its disadvantages. However, the apparatus required is relatively large and requires close control. Its use is, therefore, economical only where a fairly large and continuous output is required.



A front view of the generator

A recent development, the Nitroneal Generator made by Baker Platinum Ltd., of 52 High Holborn, London, W.C.1, provides the same sort of atmosphere by combining, in one process, the simultaneous cracking and burning of ammonia. The generator employs a platinum metal catalyst through which a controlled mixture of air and ammonia is passed. The catalyst ensures the complete reduction of all the oxygen to water vapour, which is then removed partly

by condensation and partly by conventional dryers. The dew point of the resulting gas depends solely on the efficiency of drying, and can be reduced to as low as −40° without difficulty and even lower if required. The control panel provides for easy adjustment of the ammonia/air ratio and, subsequently, automatic control ensures constant composition.

The hydrogen content of the Nitroneal gas can be varied from about 0.25 per cent all the way to 25 per cent, and a built-in analyser indicates and records the hydrogen percentage. The equipment is available in a range of sizes from 100 cu. ft. per hour upwards, and all generators, except the smallest model, are controlled automatically once the original setting has been made, i.e. any departure of the analysis from the pre-set figure operates the automatic control. Manual control only is provided on the smallest generator in order to keep down the cost and broaden its field of economic usefulness.

A particularly noteworthy feature is the rapidity with which the generator can be brought into service. It is claimed that from a cold start, a satisfactory atmosphere is produced in about 15 minutes, and that the composition of the Nitroneal gas settles down to the set figure within a further 10 minutes at the most. This is of great importance for intermittent use.

Zirconium & Titanium

Preparing These Important Metals

AT a meeting of the London Section of the Royal Institute of Chemistry held at South-West Essex Technical College, Walthamstow, on 10 February, Dr. G. L. Miller gave a lecture entitled 'The Production and Uses of Zirconium and Titanium.'

These metals have become of increasing importance in recent years, titanium for use as a constructional material, and zirconium for atomic energy projects. The problem of obtaining these metals is not one of scarcity, suitable minerals being relatively abundant. The principal source of zirconium is zircon sand and of titanium, rutile and ilmenite.

Berzelius obtained the metals in an impure state in 1824 by reducing the potassium titanium and potassium zirconium fluorides with potassium and sodium. The first pure metals were obtained by Van Arkel and de Boer in 1925, and in 1940, Kroll devised the process by which most of the world's supply of these metals is now made, namely, the reduction of the volatile chlorides by magnesium.

The Van Arkel and de Boer process depends on the decomposition of the iodide into its elements. Thus, for example, crude zirconium is heated with iodine at 150° and the iodide then decomposed on a tungsten filament at a temperature of 1,300°. Certain of the impurities in the crude zirconium tend to become deposited on the filament at the same time, and the process is now obsolete.

In the Kroll process, crude zirconium tetrachloride is purified by heating in an atmosphere of hydrogen to 200° until iron impurities are reduced to the ferrous state, and then heating to a higher temperature to sublime the $ZrCl_4$, which is collected on a cooled steel coil. The pure tetrachloride is transferred to a vessel containing a crucible filled with magnesium. The vessel is heated in an atmosphere of argon and the $ZrCl_4$ volatilises and reacts with the magnesium. The temperature of the magnesium must be higher than the melting point of magnesium chloride, but not so high as to lead to a dangerous vapour-phase reaction. The crucible is then removed, inverted and heated *in vacuo*, the magnesium chloride running out, leaving pure zirconium sponge.

The most satisfactory method for converting the metal sponge into ingots is fusion in an arc, using an expendable electrode of the zirconium or titanium sponge.

White Line Road Paint

THE British Standards Institution has just issued a standard for white line road paint. A BS/ARP Specification, 'Traffic Paints,' was issued in 1940, revised in 1943 and is now withdrawn. The present standard (BS. 2086: 1954) covers a rapid drying white paint suitable for carriageway and kerb markings, and gives performance tests for the paint relating to a reference standard paint, the composition of which is specified. The standard does not include requirements for thermoplastic compositions now commonly used for road markings. Copies of this British Standard may be obtained from the British Standards Institution, 2 Park Street, London, W.1 (price 2s.).

Fire & Explosive Hazards — Part I

by R. LONG, Ph.D. (Chemical Engineering Dept., University of Birmingham)

IN many branches of chemical industry fire and explosion hazards exist, due to the nature of the materials manufactured or handled. These include inflammable gases, liquids and solids, unstable compounds and high pressure gases.

The annual destruction of property and goods by fire is enormous* and the losses incidental to a fire, such as interruption of production, loss of records and so on may well be more serious to a firm than the direct losses. Fires on industrial premises may lead to serious explosions or, on the other hand, fires may have their origin in explosions. Disastrous explosions are fortunately rare, but even relatively small explosions can cause considerable damage, serious injuries and sometimes loss of life. As new processes are developed it is inevitable that new hazards should arise and the use of such materials as concentrated hydrogen peroxide or liquefied petroleum gases in large quantities means that suitable precautions must be taken to reduce the risk of explosion.

It is impossible to deal with the subject at all comprehensively in this article, but as the avoidance of fires and explosions depends upon an understanding of the principles which relate to flame propagation and suppression, it is proposed to illustrate these by reference to typical examples.

Inflammable Liquids

Many accidents occur when inflammable liquids are being used and these are often due to carelessness or ignorance. It is most important to ensure that inflammable liquids do not come into contact with the clothing of those who handle them[1]. Fatal accidents have occurred from the ignition of clothing which has become impregnated with inflammable solvents. Accidents have also occurred when persons have attempted to dispose of waste inflammable liquids such as solvents used for cleaning purposes, by throwing them on to a fire in a boiler or other appliance. Liquids to be disposed of should be carefully ignited on trays in the open air and not in an enclosed space where explosive vapour-air mixtures can accumulate.

In the case of liquid fuels, the flash point is a rough indication of the inflammability, and is often determined; the test appears frequently in specifications. The flash-point test is carried out mainly to ensure that the oil complies with the safety regulations affecting storage and transport of such materials. It is also a useful indication of whether any product has suffered contamination by a more volatile material. Kerosine (paraffin) and vaporising oils, for example, used in various types of lamp and in stoves such as primus stoves, must have flash-points above certain minimum figures legally defined in different countries. (Above 73° F. as determined in the Abel apparatus in the UK and the USA.)

Inflammable Gases & Vapours

The number of situations in which dangerously inflammable gases and vapours may be encountered in industry is very extensive and only a few cases can be considered here. Only mixtures of gases or vapours with air whose compositions lie between the lower and upper limits of inflammability are capable of self-propagation of flame once ignition has occurred. Obviously, wherever possible efforts must be made to keep the composition of a gas-air mixture in the atmosphere of a factory well below the lower limit of inflammability. A knowledge of the limits of inflammability of gases and vapours is of prime importance in the avoidance of explosions. A large amount of data has been accumulated and for further information the reader is directed to the comprehensive survey of H. F. Coward and G. W. Jones[2]. In all cases, however, where for any reason an explosive gas-air mixture might occur, it is essential to take all precautions to prevent ignition. Common sources of ignition include the use of naked lights, sparks from electrical apparatus, frictional sparks from the use of tools, and electrostatic sparks.

Naked lights must obviously be banned in such situations and all electric fittings must be flame-proof. The broad requirements for electric fittings which are to be

* Large fires alone resulted in an average yearly loss of over £7,000,000 in the UK in the period 1944-50.

Industrial Safety

used in an inflammable atmosphere are that:—

1. Any explosion which might occur within the fitting must not ignite the external inflammable atmosphere. It has been established that when two 'heat sinks' such as two solid plates approach each other, then a combustion wave cannot propagate past the so-called 'zone of quenching' thus formed. The channel width must not exceed a critical distance called the 'quenching distance' which depends upon the nature of the explosive gas[3]. In practice, the fitting is provided with metal flanges at least 1 in. wide machined to provide only a very narrow gap which will quench any flame passing through.

2. An explosion which occurs inside a fitting must not break it, or the glass in the case of a lamp.

3. The fitting must never become sufficiently hot to ignite the external explosive atmosphere.

4. The terminal box and the main enclosure housing a lamp must be separately flame-proof and seals through walls for the leads must also be flame-proof.

In the case of some gases such as hydrogen and acetylene, the maximum safe gap as determined experimentally is too small to be a practicable safeguard. There is also always a risk that connecting cables, even though protected by flexible metallic braid, may be damaged so that a spark may result. A method of overcoming such difficulties has been devised and it involves encasing the wires and apparatus in an envelope of non-inflammable gas such as carbon dioxide. The system is so designed that any fracture or break of the tube containing the cable, or of a lamp glass, results in the escape of the inert gas with reduction in pressure in the system. This operates a special pressure responsive switch which immediately cuts off the current and the leakage of inert gas keeps the surrounding atmosphere away for the very short period of time until the current is cut off[4].

The use of non-sparking tools has already been discussed in this series of articles[5].

Static Electricity

Although precautions may be taken to avoid risk of ignition of inflammable vapour-air or dust-air mixtures by flames, hot surfaces or sparks from electrical apparatus, there remains the risk that an accumulation of static electricity on discharge might provide a spark which will lead to an explosion, and in fact many explosions have been attributed to electrostatic discharges.

Static electric charges are easily acquired by good insulators, particularly in a dry atmosphere and, in general, whenever two electrically neutral solid or liquid surfaces which have been in contact are separated they become charged, one positively and the other negatively. The surface density of charge depends in practice upon the atmospheric conditions.

Dangerous electrification may occur in the following processes:

1. Flow and splashing of liquid: non-conducting liquids are readily electrified by flowing through pipes and the quantity of electricity produced increases as the rate of flow increases. [*See* '*Safety Notebook*'—ED.

2. Coating and spraying.

3. Power transmission by belting: the belting materials commonly used are non-conductors and easily pick up static charges which are difficult to remove.

4. Mixing, grinding and sieving.

5. Movement of dusts through exhaust ducts.

6. Movement of insulated vehicles.

7. Movement of insulated persons.

It has long been known that very small sparks may be passed through an explosive gas-air mixture without producing ignition. Careful experiment in recent years has enabled the 'minimum ignition energies' of various mixtures to be determined[6]. The igniting power of a spark is determined mainly by its energy[6,7] but some explosive mixtures can be ignited by as little as 10^{-4} joules (or even less for a vapour-oxygen mixture). These values of the 'minimum ignition energy' are functions of the mixture composition and pressure.

Certain precautions may be taken to minimise the hazard due to static electrification. These are as follows:

1. Earthing is one of the most effective ways of removing static charges. Large petroleum storage tanks, for example, are often earthed by means of a copper tape which is sweated or riveted to a copper plate fixed vertically in wet ground. Machines and storage bins and ducting are also earthed. Various methods have been des-

cribed for earthing shaft bearings, and earthed metallic combs have been used for removing static charges from belt drives.

2. By maintaining the air humidity high, it is possible to reduce the tendency for static electrification to occur.

3. Other methods have been tried based upon the principle of ionising the air and so allowing static charges to leak away from surfaces in the vicinty. Radioactive materials which emit α or β rays but not γ rays are preferable. Such materials are said to be suitable only where a comparatively slow rate of discharge is sufficient; otherwise sources of radiation too strong for the safety of personnel have to be used. β ray static eliminators containing radioactive ^{204}Tl are coming into use. The use of radium gives a faster rate of discharge but it is generally too dangerous because of the γ ray emission[8].

The whole question of static electrification has recently been the subject of a symposium held by the Institute of Physics and many valuable papers have been published.[9]

Hazards in the Petroleum Industry

In the refining of crude petroleum and in the storage of petroleum products there is always some risk of fire or explosion. Great care has always been taken to avoid, firstly, the formation of explosive mixtures (whenever this is possible) and secondly, the ignition of such mixtures in situations where they are unavoidable. One of the main sources of danger is in the essential periodical inspection, cleaning and repair of such items of plant as fractionating columns, stripping columns, cracking units, storage tanks and so on. Similar hazards arise in other industries including the manufacture of industrial solvents and the refining of crude benzole (recovered at gas works and coke-oven plants).

The lower and upper limits of inflammability of gasoline (petrol), have been found to be 1.4 and 7.6 respectively[2], and since the values depend to some extent on the composition of the gasoline, the lower limit is generally taken to be 1.0 per cent in considering explosion hazards.

The cleaning and repair of storage tanks which have contained crude petroleum, gasoline or other similar light products must be very carefully supervised. Many companies have their own stringent regulations with regard to such operations and the reader is directed to references at the end of this article for fuller details. The salient points are as follows:—

Industrial Safety

1. Although the exact technique depends upon the nature of the product formerly present in the tank or other vessel, *thorough steaming** is almost invariably employed (by means of injected live steam which distils off the lower-boiling products). There is a risk that sludge or deposits may produce vapour when disturbed and that inflammable liquid may have been trapped in hollow fittings.

Great care is necessary in dealing with this problem.

2. Ventilation then takes place (sometimes by using a steam ejector connected to the pipelines of the tank). This enables men to enter a large tank in order to carry out the cleaning which is necessary before it can be considered as ' gas-free.' The men are, of course, provided with suitable breathing apparatus. Pipe-lines and valves must be completely disconnected in the case of a storage tank on land.

3. Testing to ensure that a tank or vessel is ' gas-free ' is carried out by a competent chemist and only after a signed certificate has been granted by the chemist may men enter to carry out repair work. If sludge is present further tests must be carried out during its removal.

Petroleum hydrocarbon vapours and those of most solvents are toxic and in many refineries an atmosphere is not considered ' gas-free ' until the concentration of vapour is less than 0.04 per cent by volume[10]. Hydrogen sulphide is a dangerous gas which may be encountered in refineries, for it is extremely toxic and forms explosive mixtures with air. Special precautions have to be taken in the ' gas-freeing ' of storage tanks which have held products rich in sulphur compounds for these may contain iron sulphide. This can be ' pyrophoric,' that is to say, in the presence of oxygen rapid oxidation may cause it to glow so that it may serve as a source of ignition.

Hazards in Discharging Oil Tankers[11]

Shipment of oil in bulk has resulted in

* Precautions to prevent accumulation of static electricity are necessary; the tank and the steam pipe should both be earthed and the pipe electrically bonded to the tank.

Industrial Safety

the design of vessels specially suited for this purpose, but, in general, a vessel used for carrying crude or fuel oil cannot be used for carrying kerosine or gasoline.

Unless special precautions are taken there is, almost inevitably, an explosive mixture present in the ship's tanks at certain times. A tank which is allowed to stand for some time while it is partially filled with volatile oil contains so much vapour in the free-space above the oil that the mixture is too rich to explode (i.e. above the upper limit of inflammability). As the oil cargo is discharged, air enters the tank and mixes with the saturated vapour present. The rate of pumping is usually rapid and the upper portion of the tank becomes filled with a mixture below the lower limit of inflammability. Below this mixture there is a layer which is within the explosive range and under this a layer too rich to explode. After some time during which diffusion and convection occurs the whole tank is filled with an explosive mixture. On refilling the tank the mixture is expelled and this is usually led from the crown of the tank up the masts to not less than 12 ft. above the masthead lights, each line being provided with a goose-neck bend and flame arrester at the outlet.

A much safer method of discharging excludes air from the tanks and replaces it by flue-gas deficient in oxygen Such additions result in a narrowing of the inflammable range until ultimately self-propagation of flame is rendered impossible. Figure 1 illustrates the effect in the case of *n*-hexane (a hydrocarbon within the gasoline range). It follows, from the ordinates of the peak in the curve, that no mixture of hexane, nitrogen and air (at atmospheric temperature and pressure) can propagate flame if it contains less than 11.9 per cent of oxygen. (Jones and Kennedy)[12].

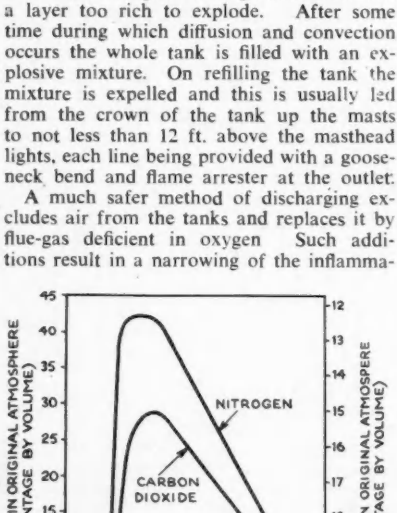


Fig. 1

A hazard arises when gasoline or other inflammable liquid is pumped into tanks. It has been suggested that the disastrous Avonmouth fire which occurred when oil was being pumped from a ship into the shore tank was due to a discharge of static electricity[13]. The oil being pumped was heavy fuel oil which had probably been contaminated by light spirit on the voyage, and turbulence on filling the tank produced an explosive mixture in the tank which was ignited by a spark resulting from a discharge when a steel tape was lowered into the tank to measure the depth of oil.

The flue gas may be taken from the ship's boilers in a steam driven vessel or in the case of motor vessels, when flue gas is normally not available, a special inert gas generator may be provided.

The general position regarding the petroleum industry has been summarised in the following quotation from a leading article in *The Times*[14]. 'Although oil installations house highly volatile substances, such precautions have been taken to prevent outbreaks (of fire) and limit the damage that insurance managers and underwriters are ready to treat them as good risks and accept the fire hazards at rates of premium which rank as moderate.'

Repair of Small Tanks

Inadequate precautions are sometimes adopted[1] in workshops and garages before attempts are made to cut small tanks with flame-cutting equipment or to repair them by such processes as soldering or welding. It must be remembered that heat will vaporise even liquids of low volatility such as diesel-oil. A number of explosions have occurred during the repair or cutting of tanks although in many cases some attempt has been made to clear them (e.g. by running hot water through). The only safe method is to blow live steam through the tank for a long period until it is completely free from inflammable liquid or vapour.

Full details are given in an official publication[15].

Hazards with Refrigeration Plants

A variety of refrigerants are used in different types of plant and some of these are capable of forming explosive mixtures with air. The lower and upper limits of inflammability of ammonia gas, for example, are approximately 15.0 and 28.0 per cent by volume in air. It has been stressed[1] after an explosion, that the concentration of ammonia gas above strong aqueous solutions of ammonia may be within the range of inflammability. Methyl chloride, also used as a refrigerant, is inflammable and may form explosive mixtures with air. It follows that leaks in refrigerating plants can be dangerous and proper maintenance is essential.

Hazards in the Gas Industry

Explosions in gas works are extremely rare in spite of the fact that during certain operations dangerously explosive coal-gas-air mixtures may be formed. The main danger arises when items of plant have to be opened for inspection or repair, when oxide purifiers (either the conventional box type or the larger Thyssen-Lenze tower purifiers) are emptied, and, of course, during the purging of gasholders.

If air is used for purging such plant, there is present in the vessel at some period, and being expelled from it, a highly explosive mixture of coal-gas and air. During this period any accidental source of ignition would give rise to an explosion. Gasholders are often situated in crowded working-class districts and near to railway tracks. The possibility of sparks or other sources of ignition can never be entirely ruled out and consequently, to ensure safety, inert-gas purging must be adopted. This method is not general in the gas industry although adopted by the larger undertakings many years ago; (it is standard practice in the USA).

The purging process involves the use of a portable inert-gas purging machine[16,17]. The inert-gas, consisting largely of nitrogen and carbon dioxide with less than one per cent of oxygen, is provided in this machine from a suitably adjusted gas burner fitted into a refractory-lined combustion chamber which is water-cooled. A gas holder may be purged either at rest in its tank or floating, for the machine can produce inert-gas at pressures up to 50 in. water-gauge (which is sufficient to raise a gasholder). The inert-gas is usually introduced through the inlet main to the holder and the gas from the holder is allowed to escape through a vent valve on the crown and is conveyed through a flexible pipe to a safe point well above ground level.

In the use of inert-gas for purging there are several stages in which the contents of the holder are (1) all coal-gas, (2) a mixture of coal-gas and inert-gas, (3) a mixture of coal-gas, inert-gas and air, since it is not practicable to displace all the coal-gas before air is admitted, and (4) all air. Stage 3 is the only one in which coal-gas and air are present together and then only in the presence of a large proportion of inert-gas.

The process depends, of course, on the narrowing of the range of inflammability of an inflammable gas by the addition of inert-gas until eventually self-propagation of flame is impossible.

The purging operation is continued until the gas issuing from the crown of the gasholder is a mixture of one part by volume of coal-gas with at least ten parts by volume of inert-gas. An air purge follows and this continues until the atmosphere in the holder permits entry. The reverse process of inert-gas purging to remove air and then, when this is completed, the admission of coal-gas, is followed when the gasholder is put back into service after the inspection or repairs. A similar process can be used in the case of oxide-purifier boxes or other gasworks plant.

Hazards in Metal Finishing

Organic stoving enamels are extensively used on motor cars, metal furniture, toys, instruments and many other articles. The stoving enamels contain thermo-hardening synthetic resins which, after evaporation of the solvents, undergo polymerisation on heating. The solvents and thinners used in those paints which are applied by spraying consist of varying mixtures of petroleum hydrocarbons, acetone, ethyl acetate, etc., and these liquids all have low flash points. They readily form explosive mixtures with air and the removal of the vapours by adequate ventilation is essential. For this reason spray-painting is carried out in spray

Industrial Safety

booths from which the vapours are withdrawn, together with large volumes of air, by fans. The exhaust systems must be designed to prevent all possibility of explosive mixtures forming in the spray booth and the fans and motors must, of course, be outside the booths. Fires in spray booths can occur if paint is carelessly spilt and if some source of ignition is present (such as may result from the breaking of an electric lamp, from static electricity or some other cause).

In recent years a new process has been devised and its use is extending[1,18]. This is one in which electrostatic precipitation is used in order to secure a uniform deposit of paint on the articles which are being sprayed. Another application of an electrostatic field is in a process known as 'dip-detearing' the object being to remove 'tears' of paint from the side and bottom of objects paint dipped. As well as an improved finish a considerable saving in paint is also achieved.

In the electrostatic deposition process, the atomised particles from the spray guns pass through an electrostatic field and acquire a charge. The droplets are then attracted to the surface to be coated which is in electrical connection with the conveyor. The resulting coating is said to be extremely uniform.

After spraying or 'detearing' operations the paint coated articles are conveyed through 'drying ovens' where the coating is stoved or baked to give a hard finish.

The risk of fire is naturally greater in these new processes because a new potential source of ignition is present. There is the possibility of an electrical discharge in the form of an arc or spark between the surrounding electrodes and the objects being treated. Fires have in fact occurred in several installations and safety precautions which are now adopted include the use of interlocking switches so that if the ventilating system is stopped or fails, the electrostatic unit is switched off[19]. Another device is designed to cut off the electricity supply if an article on the conveyor approaches too close to the electrodes.

A fire starting in a 'drying oven' might jeopardise the whole process. Several types of 'drying oven' are in use; they may be convection ovens or ovens specially designed so that heating occurs mainly by radiation (so-called radiant heating or 'infra-red' ovens) in which far more rapid stoving is obtained. 'Infra-red' ovens often make use of large banks of tungsten filament electric lamps as sources of infra-red radiation, but gas heated sources of radiation are also used (particularly in this country where fuel costs may be less with gas heated ovens). Efficient ventilation of such ovens is important in order to remove inflammable vapours, but the thermal efficiency of the process is higher if a high air temperature is maintained in the oven so that an excessive flow of air is undesirable. Proper maintenance of electro 'infra-red' ovens is necessary in order to avoid lamp breakages during operation.

The Operation of Gas-heated Ovens

A considerable number of explosions have occurred during the operation of gas-heated ovens, which are widely used. Statistics compiled by the Factory Department of the Ministry of Labour and National Service indicate that the most common causes are:

1. Delay in applying light after gas had been turned on.
2. Main cock turned on when burner cocks were already open.
3. Leakage of gas into oven before lighting up.
4. Flame failure after lighting up.

In order to prevent such explosions certain measures have been suggested[20], the fundamental precaution being to prevent accumulation of unburnt gas by;

(a) The use of automatic pilots or 'flame-failure' devices—these ensure that gas cannot be delivered to a burner until a flame is there, sufficiently close to the burner to ignite the gas and to ensure that if for any reason the flame goes out, the gas is automatically cut off.

(b) The use of low pressure cut-off vaives —these cut off the gas automatically if the pressure at a burner falls below that required to maintain a flame.

(c) The use of adequate ventilation in the operation of the oven.

(d) The fitting of explosion reliefs to ovens so that in the event of an explosion, the force of the explosion will be dissipated without causing serious damage and will be directed away from workpeople in the neighbourhood of the oven.

Part II of this article will appear in THE CHEMICAL AGE *for* 3 *April.*

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Industrial Safety

Safety Notebook

A LETTER in *Nature* for 27 February (1954, **173**, 398), from Mr. E. W. B. Gill, of the Clarendon Laboratory, Oxford, draws attention again to the fact that petrols flowing down a tube acquire quite a considerable electrostatic charge. It is perhaps less well known, he says, that the addition of alcohol reduces this charge to insignificant proportions, and some recent experiments have given very puzzling results. The pure petrol always acquires a positive charge, and the addition of slightly more than 1 per cent of alcohol reduces the charge to zero; but with the addition of more alcohol up to 8 per cent, the liquid acquires a negative charge. When the alcohol concentration is above 8 per cent, the charge is once more negligible. While unable successfully to give a full explanation of this phenomenon, Mr. Gill makes two observations: that the conductivity of the petrol-alcohol mixture increases rapidly with the addition of alcohol; and that the negative charge appears to be due to minute quantities of some third substance, possibly the small amount of water always to be found in alcohol.

* * *

AT an inquest in Huddersfield on George Henry Fielding, a retired chemical worker, who died on 3 February, the Borough Coroner, Mr. S. D. Lister, commented that it was most likely that cancer was caused by the dead man's employment and recorded a verdict in accordance with the medical evidence. The man's daughter stated that her father, a widower, had been employed by I.C.I. Ltd. for 32 years, and up to 1949, when he went to Huddersfield Royal Infirmary for examination, he enjoyed good health. In 1952 he was in Bradford Royal Infirmary for three weeks for X-ray treatment. It was stated by Mr. Robert Pollard, labour officer at the I.C.I. Deighton Works, Huddersfield, that he had reason to believe that between 1920 and 1925 Fielding had been in contact with β-naphthylamine or benzidine. According to Dr. Denton Guest, pathologist, death was due to chronic renal trouble and heart failure as the result of cancer of the bladder.

* * *

NEW high records in industrial safety performance were registered in 1953 by Celanese Corporation of America, as the company-wide accident frequency rate dropped to 1.3 for each 1,000,000 man-hours worked in comparison with a 1952 national average of 8.4 accidents per 1,000,000 man-hours worked for all American industry.

This achievement came to light with the announcement of results of the company's safety contest in which all plants and facilities competed for the annual Harold Blancke Safety Award. The top honour for 1953 was captured by the Cumberland, Maryland, acetate yarn producing plant, with a record of less than one lost-time accident for each 1,000,000 man-hours.

The actual accident frequency rate of the Cumberland plant was 0.81 per 1,000,000 man-hours worked, which represented a major improvement over the preceding year's

Industrial Safety

rate of 3.53. On two separate occasions during the year the plant achieved a record of operating 2,000,000 continuous man-hours without a lost-time accident.

Certificates of commendation in the annual contest were won by seven units which scored perfect records by not having a single lost-time accident. They were the Hopewell, Virginia, dyeing and finishing plant; the Burlington, North Carolina, spun yarn plant; the Pampa, Texas, chemical plant; the Summit, New Jersey, and Clarkwood, Texas, research laboratories; the Central Trucking facility at Cumberland, Maryland, and the New York Warehouse.

The Burlington, North Carolina, plant of the company has not had a lost-time accident in approximately four and a half years.

* * *

IT is too often forgotten that aluminium is inflammable when ignited and explosive in a finely divided form. In certain circumstances these hazardous properties can be emphatically demonstrated. Organic substances and aluminium or magnesium powders can be violently explosive, as was shown by a fatal ball-mill explosion in 1950 when carbon tetrachloride was being experimentally used in making aluminium pastes. A 30 per cent aluminium and 70 per cent CCl_4 mixture can be blow-detonated. Aluminium and liquid bromine react energetically on contact and incandescent heat can be produced; powdered aluminium and silver chloride react with increasing violence once reaction has started and the mixture can be explosive if certain proportions of the two substances happen to be present.

* * *

ALTHOUGH the splashing of acid in workers' eyes is happily becoming less common—due both to increased care in handling and to the insistence of most managements on the wearing of goggles—the provision of adequate eye-washing facilities is still a wise precaution as well as a source of confidence. An 'eye-fountain' described in the January number of *Chemische Industries* is an ingenious piece of apparatus manufactured by Ernst Haage, Mülheim/Ruhr. Two sprays deliver gentle jets of alkali, one into each eye, the liquid being turned on by pressure of the forehead on a head rest which keeps the eyes correctly positioned over the sprays. By this means, the eyes may be held open with both hands.

* * *

WITH few exceptions, managements and workpeople are showing keen interest in safety precautions since most of them realise that it pays in more ways than one to have a safe factory and a reputation for safe working conditions.

This was the view expressed by Miss M. Brand, HM Inspector of Factories, in a recent report to Stirlingshire Accident Prevention Committee. She declared that two of the chief factors leading to accidents in industry today were speed and danger money. The system of bonus and piece-work systems undoubtedly detracted from the time that would otherwise be given to the provision of more adequate safety measures.

Referring to the 'pernicious system' of paying danger money, Miss Brand said that it would be much better in the long run to spend this money on providing ways of overcoming or minimising the danger. Only safety measures, she said, could save lives.

* * *

TWO fires have broken out during the past week at the refinery of Bataafsche Petroleum Co. (Royal Dutch/Shell) at Pernis, near Rotterdam On Sunday, 28 February, about 220,000 gal. of petrol was lost in a fire, the cause of which was unknown. On the following night two tanks caught fire, and the top of one was blown off. The fire was still out of control 24 hours later, and aircraft were sent to London for additional foam equipment.

* * *

AN explosion at the Royal Ordnance Factory at Bishopton, Renfrewshire, involving the death of three process workers in a building used for washing nitro-glycerine (this building disintegrated and others were badly damaged) was the subject of a Fatal Accidents Inquiry at Paisley recently.

The factory superintendent, Mr. C. S. Livingston, said he found nothing to account for the explosion, nor to indicate any breach of the safety regulations. The area concerned had afterwards contained a quantity of unstable nitro-glycerine, which had not been used but had been burnt, and samples taken from it were found to be normal.

A chemist at the works, Mr. J. Rankine, suggested that the explosion might have

been caused by someone tapping a measuring vessel containing nitro-glycerine. There was no evidence that this had occurred, but he had seen an employee doing that on a previous occasion and had reprimanded him severely, as it was absolutely forbidden.

The jury returned a formal verdict that the men concerned died while engaged in their occupation, through there being an explosion of nitro-glycerine.

* * *

THE 6,700 workers employed by the Dunlop Rubber Co. Ltd. at Fort Dunlop have set up a record by working 1,500,000 man-hours without losing any time through accidents.

* * *

MR. W. K. OUSLEY, of the Boston Manufacturers Mutual Fire Insurance Co., recently said that every major industrial fire could have been avoided had five basic rules been followed.

First, safe construction, using resistant material and limiting undivided areas to 100,000 sq. ft. Not using wooden walls and quick-burning boards, joists, roofs, and floors.

Second, installation of complete automatic sprinkler system.

Third, provision of adequate water.

Fourth, organised fire protection and prevention training and drill for employees.

Fifth, active participation by management in developing safety consciousness throughout the works.

* * *

SEVERE damage was caused by fire recently at the factory store and office buildings of the Minnesota Mining and Chemical Co. Ltd., on the Slough (Bucks.) trading estate. Drums of inflammable solution and acetylene cylinders a few feet away from the blazing 140 ft. bay were pulled out of danger. Firemen wore breathing aparatus, but some were overcome by fumes and had to receive first-aid.

* * *

IN the United States the accident frequency at Monsanto works was reduced from 1.45 in 1952 to 1.30 in 1953, thus bringing the rate to the lowest yet scored in the history of the company. The loss of time due to accidents was also lowered, only 0.31 days being lost per 1,000 hours worked. Also in 1953 almost half the company's works were operated without the occurrence of a single major injury.

It seems likely that one factor in these achievements is the utilisation of the competitive instinct in developing high standards of safety-consciousness. The various plants compete each year for accident-freedom trophies, with plants divided into two groups according to size. In 1953 Mound Laboratory, Ohio, won the Group I trophy —4,700,000 man-hours without a major injury. The Trenton plant at Michigan won the Group II trophy and as this was done for the third year running possession became permanent according to the custom with athletic events. In a world often ready to applaud contests in danger, there is much to be said for these contests in safety.

Industrial Safety

* * *

TWO men were killed and two seriously injured in an explosion at the I.C.I. factory 'burning station' at Powfoot, near Annan, recently. A fifth man escaped injury. All were stated to be cleaning steel pipes used for carrying liquid toluene by scorching them in a fire when the pipes exploded.

* * *

A COMPREHENSIVE range of PVC fabric-supported industrial gloves and clothing to be exhibited by James North & Sons Ltd. at the next British Industries Fair will include gloves which are supplied in either red or white PVC, the former being suitable for general industrial handling and protection against chemicals, while the latter are used for the handling of food and for protection against dangerous chemicals such as ethyl lead. The North range of PVC fabric-supported garments can be made up into complete outfits of protective clothing. Their use is claimed to set new standards of durability, comfort and safety in handling chemicals of all types.

Salt Works Closing

An announcement by Imperial Chemical Industries Ltd. states that Tennants' Saltworks at Haverton Hill, near Newcastle, are to be closed down. The 55 workers there are expected to be found other employment. It is pointed out that for many years users of salt made by the open pan process such as that employed at Tennants' Saltworks, have been changing over to the more modern vacuum salt, which is more economical to manufacture and cheaper to the consumer.

Safety in Employment Bill

M.P & Growing Seriousness of Problem

MOVING the second reading of the Safety in Employment (Inspection & Safety Organisation) Bill in the House of Commons last week, Mr. William Paling said that we as a nation had been very apt to accept accidents in industry in a very casual manner. Now workers particularly were thinking much more seriously of this problem. They realised that accidents occurred at a much heavier rate than was generally appreciated; hence the growing determination to do something about it.

Most Uncertain Position

Stating that there were about 10,000,000-11,000,000 workers in respect of whom there were no statutory safety regulations, Mr. Paling said such workers had to rely upon the responsibility of the employer, a position which court decisions showed to be notoriously uncertain. Ministerial statistics showed that employment accidents causing at least three days' incapacity occurred at the rate of 700,000 a year.

On the question of skill lost to industry, Mr. Paling said that at the end of 1951 about 32,000 disablement pensioners were receiving a special hardship allowance payable where they could not do their pre-accident work. The amount of skill lost to industry and the country was a terrible toll.

At present accidents were prevented, first, by making the employer legally liable for safe plant and a safe system of work; secondly, by statutory minimum standards to be followed in mines, quarries and factories enforced by an inspectorate; and, thirdly, by voluntary efforts. The factories and mine inspectors did the best job they could, but there were not enough of them.

Mr. Paling said he wanted to see a national network of joint safety committees of management and workers, with uniformed and defined statutory powers.

In the long debate which followed, Mr. H. A. Watkinson pointed out that at present there were no fewer than 3,225 voluntary committees in factories representative of management and workers, whose functions included the promotion of safety and health among the workers. They had grown by 650 in five years and were still growing rapidly.

Progress in Foundry Resins

'RECENT Developments with Synthetic Resins in the Foundry Industry' was the subject of a paper given at a meeting of the Coventry Branch of the Institute of British Foundrymen recently by Mr. P. G. Pentz, B.Sc., technical sales manager of Leicester, Lovell & Co. Ltd., Southampton, the manufacturers of 'Thor' foundry resins.

After reviewing certain difficulties and limitations in the normal shell moulding process, Mr. Pentz made what is believed to be the first announcement in this country of a modification of the process which, it was claimed, would supersede the present methods and lead to much wider use of shell moulding. This new development—the culmination of several years' work—consists in coating individual grains of sand with a film of resin, thus eliminating certain defects previously caused by segregation and separation of the conventional powdered resin from the dry sand. Pre-coated sand eliminated health hazards, he said, increased resin efficiency, reduced mould cost and made possible the blowing of shell cores.

For Young SCI Members

A SPECIAL meeting at which young members of the Food Group of the Society of Chemical Industry will read short discussion papers on work, methods or apparatus which they think will be of interest to other young members, will be held on Wednesday, 12 May, in the rooms of the Medical Society of London, 11 Chandos Place, W.1.

Several contributions have been promised: all members born since 1920 who wish to offer papers are cordially invited to write to Dr. H. Egan, Government Laboratory, Clement's Inn Passage, London, W.C.2, if they have not already done so. Five to ten minutes only will be allowed for the presentation of each contribution. All young members of the group are invited to attend the meeting: older members are invited to introduce young members or young potential members in person.

Copper Find in Australia

From Australia it is reported that a large deposit of copper has been found 20 miles south of Alice Springs. National Lead Co., of America, is to develop the area.

Oxygen by the Ton

For Oxygen Flash Smelting Process

THE only one of its kind in Canada, a tonnage oxygen unit for producing the vast quantities of oxygen required for the direct flash smelting of copper concentrates has been placed in operation by the International Nickel Co. of Canada Ltd. Inco's new oxygen flash smelting process eliminates the fuel normally required for smelting and makes economical the present large-scale output by Canadian Industries Ltd. of liquid sulphur dioxide from furnace exhaust gases.

300 Tons Produced per Day

International Nickel's operations call for a volume of more than 7,500,000 cu. ft. of oxygen every day—enough to fill 32,000 standard cylinders. This requires the production of 300 tons of 95 per cent oxygen every 24 hours.

The oxygen plant, designed and built for International Nickel by Canadian Liquid Air Co. Ltd., is know as an 'Oxyton.' The air is first liquefied under pressure, and then the oxygen is separated from the other constituents of the atmosphere by distillation and carried as a gas through a 16-in. diameter elevated pipeline from the Oxyton to the smelter, a distance of 6,000 ft.

The important regenerator-heat exchanger system consists of two nitrogen regenerators, each 8 ft. in diameter and 17 ft. long, and two oxygen regenerators each 4 ft. in diameter and 14½ ft. long. While one pair of regenerators chills the incoming air, the other pair is being chilled by the separator gases. Working temperatures range from 26° to −170°. Since most ferrous metals suffer a marked increase in brittleness at subzero temperatures, the regenerators were made from special 8½ per cent nickel steel, developed by International Nickel for low temperature use.

Two other interesting pieces of equipment in the oxygen plant are a specially built oxygen compressor and a huge turbo compressor (required for the initial compressing of the air), one of the largest of its kind in the world. Despite its size and intricacy, the operation of the Oxyton is essentially automatic, once the liquefaction process has been started. Control and metering are carried out by modern electronic equipment with over 40 control instruments centralised on a huge operating panel.

US Pollution Conference

ONE of the biggest conferences of experts on the important problem of air and water pollution in America will be held in Houston, Texas, on 21-23 April. The Manufacturing Chemists' Association, instead of holding its own regular annual technical conference on pollution, is joining with the Southern Association of Science and Industry and the Texas Chemical Council in sponsoring the gathering, which will be known as the 1954 Southern Industrial Wastes Conference.

Mr. William C. Foster, president of the Manufacturing Chemists' Association, in commenting on the conference, stated: 'I believe this meeting provides further evidence of the continuing determination of the chemical industry, among others, to lead in the fight against pollution. Expenditure of vast amounts of scientific skill and a sum of more than $40,000,000 each year by chemical manufacturers are parts of a concerted industry-wide effort to deal with this major problem.'

Record Titanium Output

COMMERCIAL domestic production in the USA titanium metal and pigment industry reached a record in 1953 according to the Bureau of Mines, US Department of the Interior. Output of titanium metal doubled the highest peak previously reached (in 1952) and titanium pigment production slightly exceeded the high record established in 1951.

The production of commercial titanium sponge in 1953 was 2,241 short tons. This, however, was short of defence requirements and in order to increase supplies for this purpose the Defence Materials Procurement Agency signed two contracts for titanium sponge, one with the US Bureau of Mines and the other with the Cramet Co., a subsidiary of the Crane Co.

Domestic production of ilmenite concentrates was about 9 per cent lower in 1953 than in 1952. India was the major supplier of ilmenite to the US in 1953. Domestic production of rutile concentrates was slightly higher in 1953 than in 1952. Rutile concentrates were imported into the US in 1953 from Australia, the sole foreign supplier since 1947.

Fertilisers in Canada

SALES of fertilisers for consumption in Canada totalled 819,803 tons in the 12 months ending 30 June, 1953, a 7 per cent increase over the 768,545 tons sold in the preceding year, the Dominion Bureau of Statistics reports in the latest edition of its publication 'The Fertiliser Trade.' Sales of mixed fertilisers were up 4.5 per cent to 640,203, from 612,496 tons, while fertiliser materials for direct application to the soil showed a 15 per cent improvement to 179,600 from 156,049 tons.

Except for slight declines in 1941 and 1952, sales have increased every year since 1934. The 1953 total was 42 per cent greater than that of 1945, over two and a half times that of pre-war 1938, and nearly five times that of 1927. Mixed fertilisers accounted for over 78 per cent of the total sales in 1953 as compared with 1927 when fertiliser materials made up more than 62 per cent of the total.

Fertiliser exports rose 14 per cent in the latest year to 750,884 tons, more than one quarter above the 1950 movement. At 697,288 tons, exports of fertiliser materials were 13 per cent higher than in 1952, 20 per cent above three years earlier. Exports of mixed fertilisers jumped 27 per cent to 53,596 tons in 1953 and were over two and a half times as great as in 1950.

Production of lime in Canada for agricultural purposes was 13,587 tons in the calendar year 1952, down from 14,709 in 1951 and the smallest output since 1947. Production of limestone for agricultural purposes was down to 461,930 from 567,300 tons and was the lowest output since 1945.

Brazilian Asphalt

THE President of the Brazilian Republic has ordered the National Petroleum Council to continue its studies and conversations regarding the construction of a refinery for production of asphalt in Brazil.

The Brazilian Petroleum Council has been engaged in talks with the Standard Oil Company of California and its subsidiary, the International Bitumen Emulsion Corporation for an undertaking of this nature. The refinery for asphalt would be installed in the vicinity of Sao Paulo for production of 90,000 tons per annum, using as raw materials a type of crude oil found at Boscan near Maracaibo in Venezuela, and would require investment of Cr. 40,000,000.

Standard Oil is prepared to advance $900,000 for a maximum period of five years, provided that the Petroleum Council or the Brazilian Petroleum Company (Petrobas) agreed to sign a contract for the purchase of crude oil from Bascon to a total of 2,000 barrels daily for five years. The price of the crude oil will be that ruling in the international market, but transport could be performed by the Brazilian tanker fleet.

The project would mean an annual economy in exchange of $4,300,000 if transport were made in Brazilian tankers, or $3,700,000 if made in foreign tankers, and the price of asphalt would be reduced from 1,100 cruzeiros per ton to 500 cruzeiros. Local transport would be made in tank-wagons and not in steel drums.

In his Report to the President of the Republic asking for permission to continue negotiations with the Standard Oil Company, the President of the National Petroleum Council also mentioned the production of paraffin and other by-products of petroleum.

Detergent Prices Bill

THE text has been published of the Price Control (No. 1) Bill, the object of which is 'to reduce the retail price of Surf, Daz, Fab, Persil, Tide and other soap powders, soap substitutes, detergents, etc.'

The Bill, which, as stated in THE CHEMICAL AGE last week (p. 463), was introduced in the House of Commons recently by Sir Richard Acland, as a Private Members' Bill, provides that any person who sells or agrees or offers to sell at prices higher than those on the proposed schedule shall be liable on summary conviction for a first offence to not exceeding two weeks' imprisonment or a fine not exceeding £10. For a second or subsequent offence the proposed penalties are not exceeding six months' imprisonment or a fine not exceeding £100.

The President of the Board of Trade may vary the prices set out in the schedule when he is satisfied by evidence offered by manufacturers, or traders, or by organisations having at least 1,000 citizen members who are reasonably likely to be buyers of the goods, that it is reasonable to do so.

The Chemist's Bookshelf

QUANTUM CHEMISTRY. By Kenneth S. Pitzer. Constable & Co. Ltd., London. 1953. Pp. 529. Price 63s.

In the short span of half a century since Planck introduced the concept of the light quantum to account for the spectral distribution of blackbody radiation, the radical ideas of the quantum theory have permeated the whole structure of physical chemistry. At every turn, whether it be magnetic or electric susceptibilities or in nuclear phenomena the way to progress is barred unless we accept the concepts of the new theory.

There is no shortage of books which deal rigorously with quantum mechanics: nor indeed is there any shortage of the other kind which attempts to explain the quantum approach to valence bonds with hardly any mathematics at all. The importance of this new book is that it combines an adequate treatment of the fundamentals of the quantum theory with a less mathematical quantum treatment of a wide range of topics of the greatest interests to chemists.

The book is based on a course of lectures given by the author at the University of California to students who have already acquired a basis of calculus, physical chemistry, thermodynamics and nuclear physics. Although a good deal therefore is taken for granted the book is entirely suitable for a course in this country at Honours level. Herein lies the author's special contribution, for few suitable books for this particular purpose have so far been available.

The opening chapters trace the developments leading up to the introduction of the quantum concept and continue with a lucid account of the elements of wave mechanisms and the properties of wave functions. Thereafter follow chapters on kinetic theory and statistics, valence bonds, molecular spectra, crystalline solids, imperfect gases and liquids, nuclear phenomena and a number of miscellaneous topics including electric and magnetic susceptibilities and the statistical theory of reaction rates.

Much of the important mathematics has been concentrated in appendices, of which there are 24 in all, so that the main body of the book is exceptionally readable. This device has obvious pitfalls for if the appendices are neglected quantum chemistry may easily assume a very false disguise.

Professor Pitzer has himself made many contributions in this field, of which the present book is certainly not the least. It deserves to be widely used although the price is unfortunately rather high considering the type of reader to whom it is likely to prove most useful.—R. C. PINK.

SILICONES AND THEIR USES. By Rob Roy McGregor. McGraw-Hill, London. 1954. Pp. 302 + xvi. 42s. 6d.

This is a very practical book—as might be expected from an author who superintended the Corning Glass Works Fellowship research on silicones at the Mellon Institute. This practical aspect, combined at the same time with a comprehensive view of the subject, is shown in the chapters into which the book is divided: the history of silicones; commercial silicones; physiological response; applications to specific industries and cost considerations; and the chemistry of silicone preparation.

Among the very varied and almost certainly authoritative information in this book there are details of the physical properties and the ways in which silicones are being applied commercially; a tabulation of representative industries and the uses they have made of silicones, followed by a short discussion of the price situation; and a description of the reactions and techniques required for preparation of intermediates, with a section on polymerisation. There is finally a comprehensive bibliography.

This is by far the most useful book on silicones which has yet appeared, and should be of great value to the engineer and designer, as well as the chemist.—B.I.

A Great Business

The Legacy of Henry Simon

HENRY SIMON introduced into Britain two new industrial processes of considerable importance. Starting without capital or influence he built the first complete roller flour milling plant in Britain in 1878 and the first by-product coke oven installation in 1881. He died in 1899. By that time flour milling had been revolutionised; practically all the millstones had disappeared; Simon-Carves Ltd. had become the leading British firm in by-product coke oven contracting. Now, with coal washing, mechanised handling, chemical plant, steam power plant, machinery manufacture, industrial gears, and tyre retreading, the combined resources of Henry Simon Ltd. and Simon-Carves Ltd. make up one of the biggest engineering businesses in the country.

The origins, growth and present organisation of the business have been described in 'The Simon Engineering Group' by Anthony Simon, with an introduction by Lord Simon of Wythenshawe; privately printed and distributed. Impressively illustrated with photographs of directors and engineering installations at home and overseas, the book also throws some interesting sidelights on the character of Henry Simon.

In 1890 the founder of the business wrote a note for his sons, in which he urged them to acquire a sound technical education, to avoid the well-trodden arts and professions in their choice of a career, to keep in close touch with scientific development throughout the world, and to search for engineering specialities and patents which could be used to improve the efficiency of large-scale industrial processes in Britain and elsewhere.

Rarely has paternal advice and example been more wholeheartedly accepted. Nearly all the major developments of the business have closely followed the lines laid down, and the tradition of developing specialist and highly technical methods is now so firmly established that it seems almost certain to continue to guide the policy of the Simon Engineering Group.

Mansion Bought by I.C.I.

An Ayrshire mansion—Montgomerie House, Tarbolton—has been bought by the Nobel Division of Imperial Chemical Industries for use as a training centre for administrative staff.

Chemically Treated Textiles

'CHEMICAL Requirements for Treated Textiles' (BS. 2087:1954) is the title of a new British Standard issued by the British Standards Institution. Prepared in collaboration with the Joint Equipment Standardisation Committee of the Ministry of Defence, it is intended to provide in concise form details of some treatments which have been used by the Services for the preservation of textiles and to serve as a definition of the methods intended to be employed when referred to in Government departmental specifications.

Whether in use or in store most textile materials are liable to suffer damage as the result of attack by mildew, bacteria and insects. During use, textiles are often subject also to deterioration as a result of natural weathering and the action of light. The specification provides details of treatments for application to textiles which will afford some protection against one or more of these agencies.

Requirements are included which are applicable generally together with treatments and methods of application for eleven particular chemical processes. Methods of determining quantities of preservative present in treated textiles, notes on British Standard laboratory apparatus and notes on the processes are given in appendices.

Copies of this standard (4s.) may be obtained from the British Standards Institution, 2 Park Street, London, W.1, and from the Institution's Manchester office, 12 Hilton Street, Manchester 1.

£1,000,000 Plant Contract

THE Power-Gas Corporation Ltd., of Stockton-on-Tees, has just announced that in the face of very keen American competition their Australian subsidiary has secured a contract worth about £1,000,000 for the construction of chemical plant.

The contract—for Petroleum and Chemical Corporation (Australia) Ltd., Sydney—involves the design, manufacture, installation and putting-to-work of a large plant to make high-grade town gas from heavy petroleum oil along with the recovery of valuable by-products. Although the technical planning and plant design will be done at Stockton-on-Tees, much of the bulky fabricated steel equipment will be manufactured in Australia to designs sent out there.

HOME

New London Office

The London office of Joseph Crosfield & Sons Ltd., will be at Hesketh House, Portman Square, W.1, as from 15 March (Tel. WELbeck 4466; Telegrams, Savonnier, Wesdo, London).

Staff Entertained

Branch managers from London, Liverpool, Manchester and Stockton were among about 70 executives and their wives who attended the annual staff dinner and dance of J. W. Towers Ltd. at Widnes recently. Nearly 100 other employees and their friends joined in the dancing.

Titanium Oxide Selling Prices

Because of increased manufacturing costs, Laporte Titanium Ltd. have increased the selling prices for their standard range of titanium oxide pigments by the amounts stated per ton as follows: Tiona G. and Tiona S., £5; Runa Rutile Titanium Oxide, £3; Tiona 80, £4; Tiona 50 Titanium White, £3; Tiona 25 Titanium White and Tocarbo 25 Titanium Pigment, £2.

Employment Figures

Statistics published in the latest issue of the *Ministry of Labour Gazette* show that at the end of December, 1953, the number of people employed in the chemical and allied trades in Great Britain was 498,800, compared with 499,200 at the end of the previous month and 497,600 at the end of October, 1953. Most of these—212,000—were employed in the chemicals and dyes industries, compared with 211,400 at the end of the previous month and 210,100 at the end of October, 1953.

Butane-air Plants Imported

Answering a question in the House of Commons last week, the Minister of Fuel & Power, Mr. Geoffrey Lloyd, said the Wales Gas Board had received licences to import three butane-air plants from the US and had also imported one from France under open general licence. He understood that the plants had so far proved satisfactory. The Gas Board was now considering the installation of additional plants and was experimenting with the use of propane in place of butane.

Change of Address

Glycerine Ltd. recently moved from Unilever House to Hesketh House, Portman Square, London, W.1. The telephone number is Welbeck 4466 and the telegraphic address is 'Glymol Wesdo, London.'

Plasticiser Price Reduced

British Industrial Solvents has announced that the price of 'Bisoflex 91' (Dinonyl phthalate) has been reduced by 4d. per lb. The new schedule ranges from 1s. 11½d. per lb. for 10 tons, spot or contract over six months, carriage paid in returnable drums, to 2s. 4½d. per lb. for 5-gal. lots, carriage paid, packages included.

Keeping Up the Pace

Speaking at Billingham last week during a presentation of long service awards to I.C.I. employees, Mr. W. D. Scott, managing director of the Billingham Division, said that although competition overseas was increasing and rising costs would affect the competitive home market, he was confident that 1954 would be another good year for the division, which was expanding rapidly.

New I.C.I. Silicone Plant

Imperial Chemical Industries Ltd., is to build its own silicone manufacturing plant at Ardeer, Ayrshire. At present the company handles the range of silicone fluids, resins, elastomers and other miscellaneous silicone products produced by the General Electric Co. of America. The new plant will produce silicones similar to those at present imported, together with new products required to meet special demands.

ABCM Address Changed

On and after Monday next, 8 March, the address of the Association of British Chemical Manufacturers and affiliated associations operated by ABCM staff will be Cecil Chambers, 86 Strand, London, W.C.2 (Tel. COVent Garden 2363; Telegrams, Manuchem, Rand, London). The affiliated associations affected are Association of British Insecticide Manufacturers, British Barytes Producers' Association, British Colour Makers' Association, British Disinfectant Manufacturers' Association and Industrial Pest Control Association.

· PERSONAL ·

DR. R HOLROYD, Director of Research, I.C.I., is to become chairman of the Food Investigation Board, DSIR, on 31 March, consequent upon the retirement of SIR FRANK ENGLEDEW. Dr. Holroyd's term of office is five years.

MR. G. W. CHERRY, of the West Midlands Gas Board, has been elected hon. secretary of the Midland Society for Analytical Chemistry in succession to MR. W. T. EDWARDS, who is shortly moving to the Department of Atomic Energy. All communications for the Society should now be sent to Mr. Cherry at 48 George Frederick Road, Sutton Coldfield.

After 43 years' service in the electricity supply industry, MR. A. B. OWLES is retiring from his post as North-Western Divisional chemist of the British Electricity Authority. Mr. Owles, who has been in charge of the 17 laboratories, was formerly chief chemist at the Manchester Corporation Electricity Department.

The committee of the Fine Chemicals Group, Society of Chemical Industries, has unanimously approved the appointment of DR. H. J. BARBER as chairman for the 1954-55 session.

MR. C. E. WRANGHAM, one of three newly appointed part-time members of the Monopolies Commission, has been a director of G. Tennant Sons & Co. Ltd. since 1938 and controls their chemical and general export departments. He is also a director of other companies, including Power-Gas Corporation Ltd.

MR. M. G. JOHN, chief physicist in the laboratories of T. Wall & Sons Ltd., has been presented with a gold watch for 15 years' meritorious service. Mr. John, who is in charge of the physical laboratory under the firm's chief chemist, DR. S. M. HERSCHDOERFER, received his watch from the chairman, MR. CECIL W. RODD, at a ceremony at Hammersmith Palais when some 2,500 Wall's employees were entertained to a buffet-supper and dance.

MR. JOHN BARRITT, assistant director of research to the Wool Industries Research Association, Torridon, Leeds, and a former hon. secretary of the Society of Dyers and Colourists, has been elected an honorary member of the Society for outstanding services to it. He joins a select company which includes famous dyers, both past and present, among those of more recent times being PROFESSOR F. M. ROWE, of Leeds University, and DR. C. J. T. CRONSHAW, formerly a director of I.C.I. Ltd., and for five years president of the Society. Mr. Barritt was the Society's hon. secretary from 1946 until last year when he was obliged to retire from that post owing to the pressure of his duties with the Wool Industries Research Association.

The Senate of the University of Sheffield have appointed DR. A. R. ENTWISLE, a graduate of Cambridge who for some time past has been engaged in metallurgical research in Sheffield, to be the first United Steel Companies' Research Fellow in Metallurgy. Dr. Entwisle will study the effect of interstitial elements on the formation of martensite.

MR. W. R. BRANSON, chief technical officer of the East Midlands Gas Board, has been appointed deputy chairman of the West Midlands Gas Board, in succession to MR. A. W. LEE, who is retiring at the end of April on completing his term of office. MR. J. CARR, general manager of the South Western Gas Board, has been appointed deputy chairman of that Board. He will succeed MR. E. R. V. PORTER, who also retires at the end of April on completing his term of office. Mr. Porter will remain on the Board, however, as a part-time member.

The Royal Society's Bakerian Lecture will be delivered on 17 June by PROFESSOR A. R. TODD, F.R.S., Professor of Chemistry in the University of Cambridge, and will be entitled 'Chemistry of the Nucleotides.'

The Leeuwenhoeck Lecture, founded in 1950, will be delivered on 6 May by PROFESSOR J. H. QUASTEL, F.R.S., Professor of Biochemistry, McGill University, Montreal, and Director, Research Institute, Montreal General Hospital, and will be entitled 'Soil Metabolism.'

MR. H. HEATHCOTE, technical director of Spencer Chapman & Messel Ltd., has been appointed chairman of the company in succession to the late Mr. FitzRoy K. Chapman.

Obituary

The death occurred on Monday, 1 March, of GERTRUDE MAUD, LADY ROBINSON, wife of Sir Robert Robinson, Waynflete Professor of Chemistry in the University of Oxford. At a recent ceremony in Oxford, when an honorary M.A. was conferred upon her, the Public Orator described Lady Robinson as a wife who deserved praise not only for the help she gave her husband as hostess to fellow scientists from many countries, but for sharing his professional interests in the laboratory. She was to be praised too for her own discoveries and for 'adding a subtle flavour of informality and charm to the high seriousness which chemical study demands.'

The death has occurred of MR. FRANK SAMUEL (65), chairman of the United Africa Company and a director of Lever Brothers and Unilever. He suggested what ultimately became the East Africa groundnuts scheme. The United Africa Company pioneered the project before the Overseas Food Corporation was set up. Mr. Samuel joined the United Africa Company in 1929 as Gold Coast merchandise manager. Two years later he was appointed joint managing director and eventually became sole managing director, and a director of Unilever, the parent company. The post of executive vice-president was created for him in 1952.

MR. CHARLES ELLIOTT, a former chemist on the staff of Lever Bros, Port Sunlight, has died in Santiago, Chile, where he was chief chemist to the Braden Copper Company.

The death has occurred in a Glasgow hospital of MR. GEORGE STARK CHRISTIE, a former chairman of Messrs. George Stark & Sons Ltd., Grove Park Paper Mills, Glasgow. Mr. Christie joined the company under his father, served them for about 60 years, and was chairman from 1919 until he retired in 1949. He was 79.

Mathieson Chemical Records

MATHIESON Chemical Corporation, Baltimore, again set new records last year in both sales and income, according to the company's recently issued annual report. Sales brought in $243,575,544, compared with $147,109,581 in 1952. Net profit after taxes was $18,755,813, compared with $13,553,368.

The report is the first to include a full year's operations of E. R. Squibb & Sons, which was merged with Mathieson on 1 October, 1952. On a pro-forma basis, combined sales of the two companies in 1952 were $215,662,550, and combined net profit $14,503,152.

Mr. Thomas S. Nichols, president and chairman, said that all of the company's divisions—industrial chemicals, hydrocarbon chemicals, agricultural chemicals and drugs—registered gains over 1952. Industrial chemicals had an outstanding year, with sales at a new record, and Squibb Division sales and profits showed a marked improvement over 1952.

In a letter to shareholders, Mr. Nichols said further:—'Additional expansion in our facilities for high analysis fertilisers was completed at the year-end and the outlook for the approaching season is good. Squibb of Argentina opened its new research laboratories in Buenos Aires during the year. These are the largest and best equipped laboratory facilities in Latin America and will contribute to the research activity of the corporation as a whole.'

Canadian Split-up

It was announced from Montreal last week that the British and American stockholders of Canadian Industries Ltd. plan to divide the business into two distinct companies. The scheme has been drawn up by the two principal stockholders, I.C.I. and E.I. du Pont de Nemours, and is partly a result of the anti-trust judgment given in the US in 1952, which directed the two companies to separate their joint interests in North and South America.

More Canadian Uranium

The Quebec Government has announced the discovery of uranium deposits at Oka, about 40 miles west of Montreal. In the same area thorium, columbium and tantalum have also been found.

Publications & Announcements

SINCE 1934, analytical reagents issued by The British Drug Houses Ltd., Poole, Dorset, have conformed to the specifications of purity compiled jointly by BDH and Hopkin & Williams Ltd., and published as 'AnalaR Standards for Laboratory Chemicals'; and since 1951, 'MAR' reagents have been available to specifications for micro-analytical work. Now it is announced by BDH that details of minimum assay and of maximum limits allowed of the more significant impurities will in future be printed on the labels of some 1,500 items in the range of BDH laboratory chemicals. The new specifications do not establish 'analytical reagent' standards, but it is hoped that they represent a high level of quality for normal laboratory purposes.

* * *

THE first issue of 'Current Iodine Literature,' listing 89 references classified under appropriate headings, has recently been published by the Chilean Iodine Educational Bureau, Stone House, Bishopsgate, London, E.C.2, from whom copies may be obtained. It is stated that subsequent issues will follow at regular intervals. The advisory services of the bureau and its reference collection of iodine literature numbering more than 30,000 items—claimed to be the most complete collection of iodine data in existence—are at the disposal of those who require them, without obligation.

* * *

REPORTS of the work of the Department of Scientific & Industrial Research appear in the publications of learned societies and professional institutions, or in the scientific, technical or trade periodicals, or as publications of HM Stationery Office or the DSIR. Complete lists of reports and papers issued by the DSIR are included in the various annual reports. HMSO Sectional List No. 3 of Scientific & Industrial Research Publications, revised to 1 December last, contains publications issued by the Stationery Office or the DSIR which are still in print or in the press.

* * *

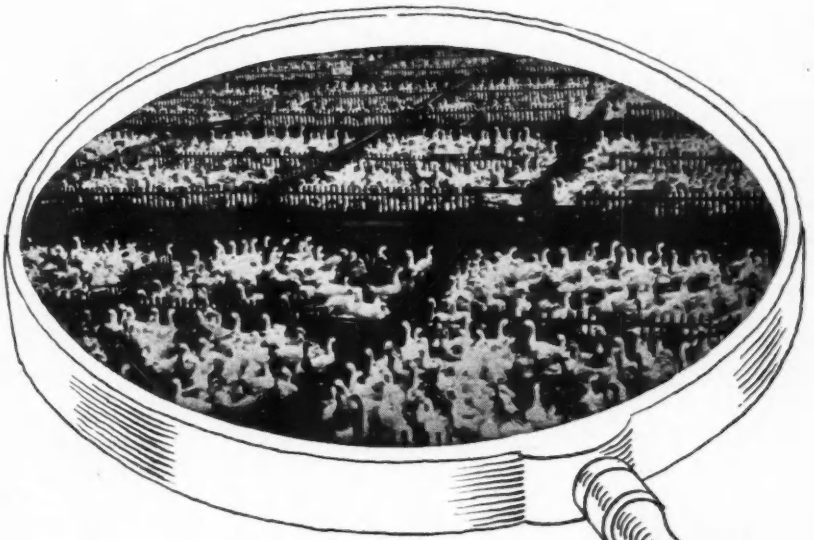
GLUE specifications, the storage of urea resins and cold weather gluing are among the subjects covered in the first issues of a series of publications entitled 'Glue Lines.' These are being issued by Leicester, Lovell & Co. Ltd., North Baddesley, Southampton, with the object of providing glue users with useful information in a form which can be kept and used for reference when required. Future issues will include information on new and interesting gluing techniques and details of the problems and difficulties which from time to time occur in gluing operations.

* * *

DEVELOPED to meet the longfelt demand for a simple, safe and mechanically controlled device to replace the distasteful and often dangerous method of filling pipettes by mouth, the 'Pumpett' is made by the Shandon Scientific Co., of 6 Cromwell Place, London, S.W.7. The device consists of an acid resistant moulded plastic body surmounted by a surgical grade rubber operating bulb. The body houses a stainless steel mechanism which operates the rubber-lined chuck jaws which grip the pipette, the coarse air control and the micro control screw valve. This last is the most important feature of the apparatus, and even in the case of very fine micro pipettes with contents of a few thousandths of a ml., positive and accurate control is possible, it is claimed. The Pumpett will accommodate all sizes of pipette, and they may be picked up from the rack by means of the jaws, using one hand only. The components are readily dismantled for cleaning, should they become contaminated; and the device is suitable for right or left hand.

* * *

'WIGGIN Nickel Alloys No. 25' contains a description of the automatic temperature control device now fitted on the 'Singer' iron. The accuracy of this new control, which is based on the expansion of the sole plate, is so good that scorching would seem to be impossible at normal ironing speeds. Another new development described is an ultrasonic vibratory drill now being marketed by the Mullard Company. Articles of interest to the petroleum industry deal with the Atlantic Refining Works, a tank cleaning machine and hydraulic valves. A description of a liquid-filled recording thermometer system, and a short article of interest to people who have to fabricate after plating, are also included.



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Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages & Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary but such total may have been reduced.)

DECRA PLASTICS LTD., London, E. 20 January, charge, to Barclays Bank Ltd. securing all moneys due or to become due to the bank; charged on 9a Napier Road, Wanstead.

PLASTONAL LTD., Belvedere, manufacturers of resins, etc. 19 January, debenture, to Barclays Bank Ltd. securing all moneys due or to become due to the bank; general charge. *Nil. 12 August, 1953.

Satisfactions

POLLOPAS PATENTS LTD., London, W., manufacturers of chemical products, etc. Satisfaction, 5 February, of mortgage registered 5 January, 1953.

PORTLAND PLASTICS LTD., Hythe (Kent). Satisfaction, 28 January, of charge registered 10 March, 1949.

New Registrations

Santonin Marketing Co. Ltd.

Private company. (529,119). Capital £6,000. Objects: To obtain, extract, isolate, refine and purify the chemical compound known as santonin, and to manufacture, prepare and produce mixtures, compounds, preparations and substances of all kinds, containing santonin. Power is also taken to carry on the business as flower, fruit and vegetable growers, etc. Directors: Denys L. T. Oppe, Leslie W. Dodds and Edmond R. H. Pollack. Reg. office: 4 Grafton Street, London, W.1.

Magowan Vicars (Chemicals) Ltd.

Private company. (N.I.3,300). Capital £100. Importers, exporters and manufacturers of and dealers in insecticide, fungicide, rodenticide and fertiliser preparations of all kinds, etc. First directors not named.

Elfeen Rose Products Ltd.

Private company. (529,051). Capital £100. Manufacturing and retail chemists and druggists, etc. Directors: Cecil F. Mattocks and Daphne G. Hollands. Reg. office: Fairfield, Tunbury Wood, nr. Rochester, Kent.

Jonathan & Richard Ltd.

Private company. (529,226.) Capital £500. Manufacturers of dry cleaning solvents, cleansing fluids, detergents, etc. Directors: Raymond Plant and Mrs. Cynthia B. Plant. Reg. office: Twenty Three, Wapping, Liverpool.

Fertilisers & Chemicals Ltd.

Private company. (529,176.) Capital £100. Buyers, sellers, exporters, importers, manufacturers and brokers of and dealers in agricultural and chemical fertilisers, feeding stuffs, gelatine, glue, oil cake, oils, greases, etc. Directors: C. A. A. Miller, L. Leiner. Reg. office: Thorners Chambers, Ingram Court, 168 Fenchurch Street, London, E.C.3.

Company News

Anchor Chemical Co. Ltd.

A final dividend of 22½ per cent in respect of the year ended 30 November last is being paid by the Anchor Chemical Co. Ltd., making a total of 30 per cent for the year. This compares with a total of 25 per cent for the previous year. Group trading profits, adjusted for all revenue items, rose by £44,241 to £101,474. After a higher tax provision—£53,611 as against £33,320—the net balance is doubled at £47,863.

Olympic Portland Cement Co. Ltd.

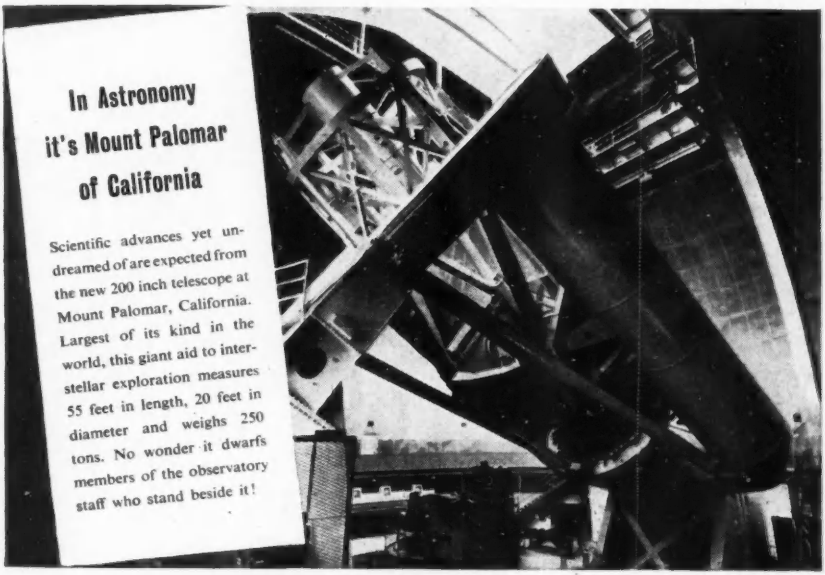
A falling-off of business during the year ending 31 March next is referred to by the directors of the Olympic Portland Cement Co. Ltd. Deliveries of cement for the ten months to 31 January last were 123,000 barrels less than those for the corresponding period last year. The interim dividend is maintained at 4 per cent.

Hickson & Welch (Holdings) Ltd.

The directors of Hickson & Welch (Holdings) Ltd. have decided to recommend at the

(continued on page 588

A GREAT RANGE



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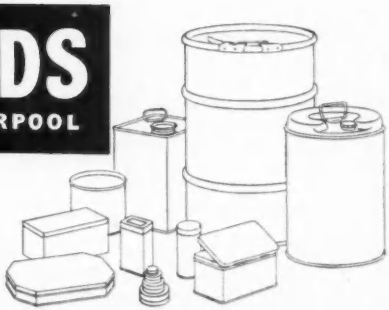

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forthcoming annual meeting a final ordinary dividend of 5½ per cent in respect of the year ended 30 September last. With the interim dividend already paid, this makes a total of 8½ per cent, compared with 7½ per cent last year. After taxation of £74,455 (as against £90,973 for the previous year), group net profit was £57,961 (£49,427).

Redfern's Rubber Works Ltd.

The directors of Redfern's Rubber Works Ltd. will recommend to the annual general meeting on 31 March that the following dividends be paid: 3¾ per cent on the A and B Preference shares, making 7½ per cent for the year; 5 per cent on the Ordinary shares, making 10 per cent for the year, plus a bonus of 7½ per cent. The share registers will be closed for transfers from 17-31 March inclusive. The accounts and report will be circulated later but meanwhile the following are details from the consolidated accounts of the company showing comparative figures for 1952 and 1953.

		1953	1952
		£	£
Profit on trading		75,051	79,339
Adjustment for exceptional items :—			
Additional provision for deferred repairs	£ 9,000		
Profit on sale of fixed assets	2,935		
		6,065	Nil
Net profit before taxation		68,986	79,339
Less taxation		30,720	43,923
Net profit after taxation		38,266	35,416
Net amount absorbed by the dividends proposed above and the interim dividend		16,500	15,750

The taxation provision for the year has been reduced by a claim for repayment of Excess Profits Tax of £3,950 arising from the claim for deferred repairs and adjustments for previous years of £2,847 which are mainly due to the reduction of the standard rate of income tax for 1953/54.

Solidol Chemical Co. Ltd.

The board of Solidol Chemical Co. Ltd. have announced a proposal to reduce the issued share capital, all in ordinary shares, from £188,157 to £7,839 by cancelling 1s. 11d. on each of the 2s. ordinary shares. A 'rights' issue of ordinary shares may be made later. After the reduction, it is planned to consolidate the 1d. shares into 2s. shares and to re-increase the authorised capital to its present figure of £200,000 by creating 1,083,177 further 2s. ordinary shares. When this reorganisation is complete the directors will subsequently issue ordinary shares at par in satisfaction of £16,864 of outstanding loan accounts. If the scheme is approved, the directors state, they will be able to give further consideration to the proposed acquisition of shares in Ashe Laboratories Ltd., a private company, in which case it will be necessary to make a 'rights' issue of ordinary shares.

Market Reports

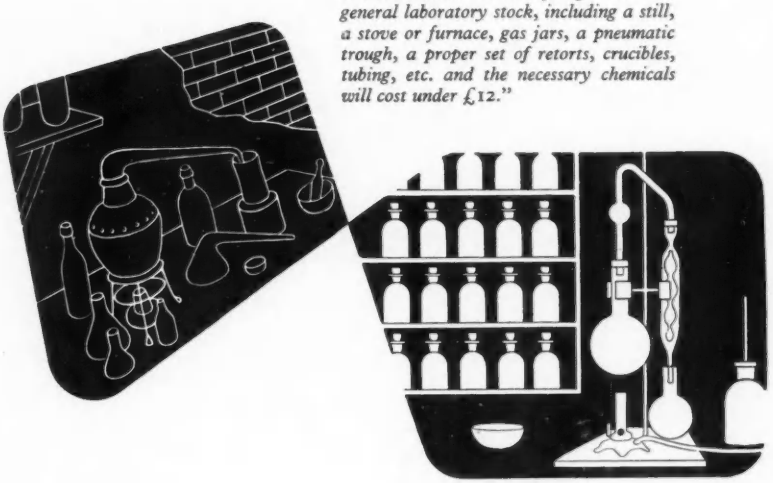
LONDON.—The industrial chemicals market has shown no particular trend during the past week. However, an active interest has been displayed in most sections and good quantities against contracts have been taken up by consuming industries. The demand for the majority of the potash and soda chemicals continues on steady lines with prices well held at recent levels. Among the miscellaneous products formaldehyde, arsenic and hydrogen peroxide are receiving good attention and reports indicate a better supply position for titanium dioxide and phthalic anhydride. In the coal tar products market quotations for naphthalene are firmer on a good demand, whilst there has also been a good call for phenol and meta-cresyl. The solvents are short relative to demand.

MANCHESTER.—Manchester traders during the past week have experienced a steady flow of delivery specifications under contracts covering a wide range of heavy chemicals for the textile and allied industries and other leading outlets. There has also been a fair number of additional inquiries for the alkalis and other products on home trade account. On the whole, shipping business is keeping up fairly well. With an odd exception prices maintain a steady front. In the fertiliser section there is a satisfactory movement of basic slag and the compounds and interest in other lines is gradually increasing. Most of the tar products, both light and heavy, are going steadily into consumption.

GLASGOW.—A further fall in the price of some solvents and plasticisers was welcomed during the week, otherwise, with the exception of a slight change in some zinc and lead salts, prices have been steady. Trading has been very good this past week with the majority of the consuming industries, and looks like continuing. Export on the other hand has been rather quiet.

A rough and shabby room

"For teaching chemistry, a laboratory is absolutely essential No matter how rough and shabby a room, so that it be well ventilated, have gas and water laid on, and will hold sixteen to twenty boys . . . . the general laboratory stock, including a still, a stove or furnace, gas jars, a pneumatic trough, a proper set of retorts, crucibles, tubing, etc. and the necessary chemicals will cost under £12."



Standards, like prices, have gone up since 1869, when the first issue of Nature reproduced an address presented by the Rev. W. Tuckwell to the British Association Meeting in Exeter containing this passage.

Much good work was done in the "rough and shabby rooms" of a century ago; but the layout and equipment of the modern laboratory, and the stocks of B.D.H. reagents on its shelves, bear witness to the standards that are considered essential to-day.

LABORATORY **B·D·H** CHEMICALS

THE BRITISH DRUG HOUSES LTD B.D.H. LABORATORY CHEMICALS GROUP POOLE DORSET
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Next Week's Events

MONDAY 8 MARCH

Royal Institute of Chemistry

Woolwich: Polytechnic, S.E.18, 6.45 p.m. Joint meeting with Polytechnic Scientific Society. G. T. Rogers: 'Explosions in Solids.'

Institute of Metals

Glasgow: 39 Elmbank Crescent, C.2, 6.30 p.m. Dr. D. D. Howat: 'Powder Metallurgy.'

Society of Dyers & Colourists

Manchester: College of Technology, 6.30 p.m. Junior Branch meeting. D. G. Evans: 'Cibalan Dyes—Nylon & Nylon Unions.'

TUESDAY 9 MARCH

Chemical Society

Exeter: Washington Singer Laboratories, 5 p.m. Tilden Lecture. 'Aromatic Characters in Seven-membered Ring Systems.'

Leeds: The University (Chemical Lecture Theatre), 6.30 p.m. Joint meeting with University Chemical Society. Professor D. H. R. Barton: 'The Stereochemistry of *cyclo*-Hexane Derivatives.'

Society of Chemical Industry

Bangor: University College, 5.45 p.m. G. E. Blackman: 'Selective Herbicides & the Principles of Selective Toxicity.'

Society for Analytical Chemistry

London: Chemical Society's meeting room, Burlington House, Piccadilly, 6.30 p.m. Meeting on 'Refractometry & Interferometry.'

Midlands Society for Analytical Chemistry

Birmingham: The University, Edmund Street, 7 p.m. Dr. R. A. Mott: 'Recent Developments in the Analysis of Coal & Coke.'

WEDNESDAY 10 March

Society of Chemical Industry

York: Station Hotel, 6.30 p.m. Dr. A. G. J Lipscomb: 'Unsolved Problems in the Production of Food—3, Chocolate.'

Institution of Chemical Engineers

Birmingham: The University, Edmund Street, 6.30 p.m. A. H. Goodger: 'Design of Pressure Vessels & the Mechanism of Failure in Service.'

THURSDAY 11 MARCH

Royal Institute of Chemistry

Acton: Technical College, High Street, W.3, 7 p.m. Joint meeting with Technical College Scientific Society. Professor D. H. Hey: 'Developments in the Chemistry of Free Radicals.'

Society of Chemical Industry

Liverpool: The University (Chemistry Lecture Theatre), 6.30 p.m. Annual general meeting of Oils & Fats Group, followed by paper by J. Holmberg: 'Investigations on Animal Fats.'

Society for Analytical Chemistry

Edinburgh: George Hotel, George Street, 7.15 p.m. H. A. Willis: 'Applications of Infra-red Spectroscopy.'

Institute of Welding

London: 2 Savoy Hill, W.C.2, 6.30 p.m. Joint meeting with Chemical Engineering Group, SCI. J. F. Lancaster: 'Welding of Stainless Steel Vessels.'

Liverpool Metallurgical Society

Liverpool: The Temple, Dale Street, 7 p.m. P. L. Teed: 'Titanium—a Metal of Engineering Importance?'

Institution of Chemical Engineers

Manchester: College of Technology, Sackville Street, 6.45 p.m. Graduates & Students Section, Manchester Centre. F. P. Stainthorp: 'Chemical Reaction Accompanied by Distillation.'

Leeds: The University (Fuel Department), 7 p.m. Graduates & Students Section, Yorkshire Centre. A. Woodwark: 'Liquid-liquid Extraction.'

FRIDAY 12 MARCH

Chemical Society

Birmingham: The University (Chemistry Dept.), 4.30 p.m. Joint meeting with University Chemical Society. Dr. D. Tabor: 'Friction & Lubrication.'

Society of Chemical Industry

Cardiff: University College, 7 p.m. Jubilee Memorial Lecture, 'The Production & Use of Fertilisers—Some Recent Trends & Problems,' by E. M. Crowther.

SATURDAY 13 MARCH

Institution of Chemical Engineers

Manchester: College of Technology (Reynolds Hall), 3 p.m. H. J. Thurlow: 'Description & Uses of a Research Experimental Plant.'

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Applications for enrolment for the Academic Year, 1954-55, may now be made on forms to be obtained from the Secretary.

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INDEX TO ADVERTISERS IN THIS ISSUE

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